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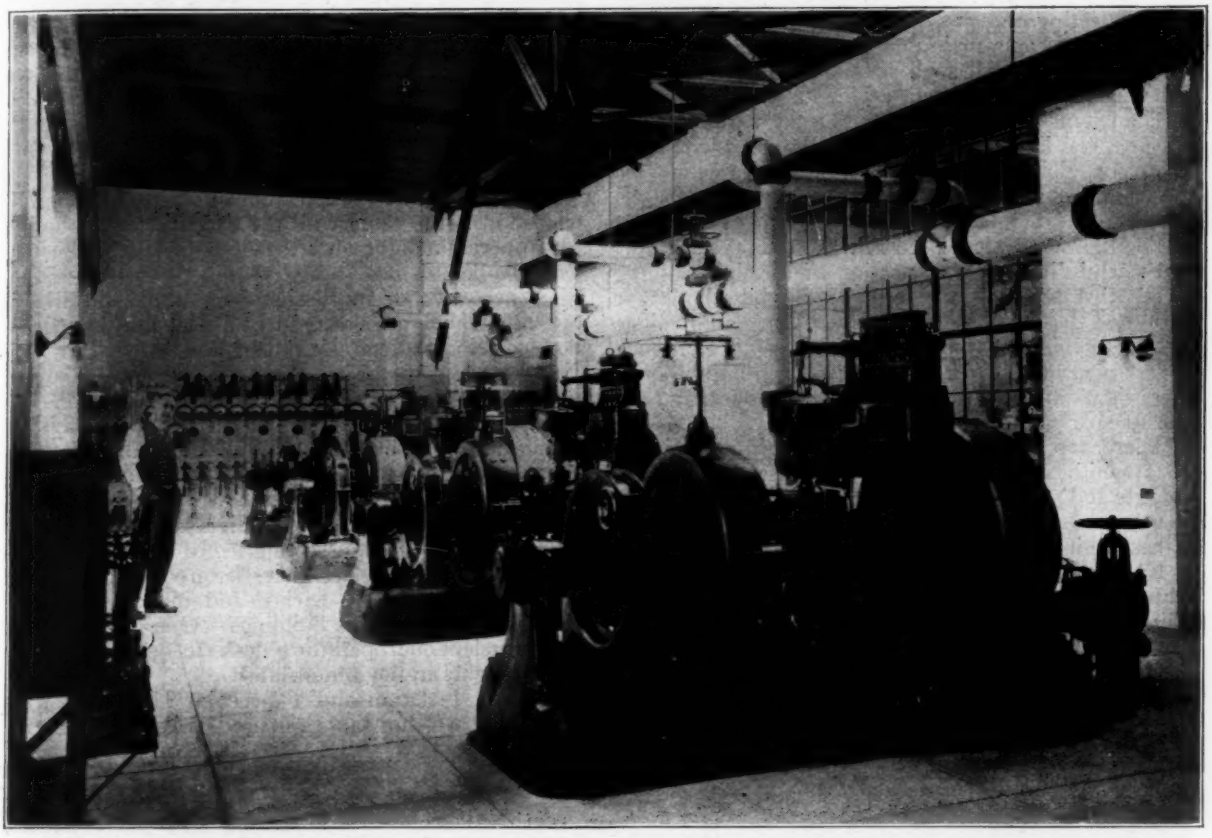


View in the Turbine and Generator Room of the San Francisco Hospital—Four 125-kw. Generating Sets.

Some Electrical Features of New San Francisco Hospital

Municipal Institution Has Complete Power Plant, Silent-Call Signals, Numerous Electric Elevators, Electric Clocks, Modern Laundry and Kitchen Equipment, Electrotherapeutic and Laboratory Apparatus, Etc.

THE new San Francisco Hospital, which is maintained by the city and county of San Francisco, Cal., for the treatment of the sick poor, is admittedly one of the finest and most complete institutions of its kind in America. The hospital comprises a group of buildings costing $3,500,000, one of which is a very modern and efficient power plant for generating the electric current for light and power, the hot water and steam heat and other utilities used throughout the institution.

This hospital group is completely isolated from all outside sources of current, and because of this fact great care is taken to insure the efficient operation of the generating equipment at all times. The power plant is situated in the center of the group of hospital buildings. It contains four 250-hp. Heine water-tube boilers, carrying 175 lb. steam pressure, which are fired with crude oil by the Dahl system. The oil is heated to a temperature of 270° F. under a pressure of 130 lb., thus doing away with the necessity of steam or air atomizing.

The electric generating equipment consists of four 125-kw. Curtis direct-current turbine-generator units, running at 2400 r.p.m. The generators are of the three-wire type, delivering direct current at 125 volts for lighting and 250 volts for power. The main

switchboard is also located in the room with the generators and distributes both light and power to all of the buildings through individual feeders to each. Feeders and branch circuits are figured for a maximum voltage drop of 2½%.

The main switchboard includes the generator panels, a main power panel, a paralleling panel, and the lighting and power panels.

All electric wires, as well as all pipes for steam, hot and cold water, etc., are run in a system of tunnels connecting the power plant with each building. Each building has a main distributing switchboard for light and power. All such switchboards are enclosed with wire netting to prevent accidental contact.

The extensive yards surrounding the various buildings are well lighted by 30 electric lamps enclosed in opalescent globes, supported on concrete columns. These lights are controlled by six remote-control switches operated from the main switchboard.

The lighting system used in the buildings is chiefly of the semi-direct type, a portion of the light coming directly through the translucent bowl, while the major portion of the light is reflected from the ceiling. The general corridor lighting consists of two circuits, one for evening lights and the other for all-night lights. These lights are enclosed in opalescent globes, and are 25-watt size.

There are six specially designed lighting units in the amphitheaters, some of which are attached to brackets and some are adjustable vertically. There are 12 40-watt Linolite lamps in each lighting unit. One of these units is shown in an accompanying view.

Each of the main wards has seven semi-direct lighting units of 150 watts each suspended from the ceiling in the central aisle of the room. Each bed has a bracket reading lamp over the head; this is equipped with a metal shade. Incorporated in this lighting fixture is the silent-call system pilot light.

This silent-call system is controlled from the patient's bed, and is operated on the 125-volt lighting circuit. Upon the patient's pressing a button in a flexible cord attached to the bed, it lights a green lamp on top of the bracket fixture over the bed, also a green light at the nurse's desk, one in the ward corridor, one in the diet kitchen and also in the main office directly over the private exchange board, thus increasing the chances of all calls being answered promptly. By means of a signal board, operated in conjunction with the silent-call system, the telephone operator records on a time stamp the time when the patient's call is registered and the time it is answered by the nurse.

The operation of the signal system is as follows: When the patient presses the button at the bed, the lamp over the bed lights and operates a relay; the relay in turn operates the lights as previously described.

In the two-bed ward rooms on each floor, the operation is the same with the exception that the buttons operate a light over the door outside, instead of over the bed.

Where two or more signal lights are installed at one point, they are enclosed in a neat galvanized-iron box of No. 14 iron set flush, and fitted with door frame and ground-glass panel, with the face of the glass lettered, designing the various calls. This box also provides room for the sockets, lamps, relays and connections. There are 468 patient's calling stations on the system just described. This is known as the Butte system.

An annunciator of 18 pilot lights is installed in the administration building, composed of a galvanized-iron box, with ground-glass face, lettered and numbered to conform with the wiring and indications of the calls from the various buildings. One light is placed on the telephone operator's desk, to operate with the telltale lights in the annunciator.

In the Isolation and Tubercular Hospitals, which form part of the San Francisco Hospital and which

One of the Main Wards in San Francisco Hospital—Each of These Wards Is Lighted by Seven 150-Watt Semi-Indirect Lighting Units in the Center and There Is a Bracket Reading Lamp Over the Head of Each Bed—Above Each Bracket Is the Pilot Lamp of the Silent-Call System.

have quite recently been completed, a system of 368 calling stations has been installed. The Bryant system is used here and two Brystol time recorders automatically record the time when calls come in and when answered.

The Winkler Reichmann loud-speaking telephone system has just been installed in the recently completed Isolation and Tubercular Hospitals. The duplex voice type of transmitters are used. The receiving horns are divided into 4 circuits, from 7 to 9 horns being on each circuit. There are 2 horns on each floor of the new building. The horns are located at the most convenient place for sending the sound of the operator's voice down the corridors. The calls are heard by one of the nurses that are usually stationed in the corridors, who notify the person that is wanted without disturbing any one else.

Electric Clock System.

The time system is operated through a master clock in the superintendent's office, from which an electric impulse is sent to each of the secondary electric clocks throughout the building every minute.

The master clock is of the standing hall type, having a 14-in. silvered metal dial, with cast bronze raised Arabic numerals and minute dots. It is fitted with a Graham dead-beat escapement and a 60-beat compensated mercurial pendulum having micrometer adjustment. The movement is self-winding, having a minute rewinding mechanism. All circuit-closers are of the oscillating, self-cleaning type.

The master clock is equipped complete for operating seven circuits of secondary clocks, 135 in all, and three time stamps, having one dead-beat battery gage, and four pilot indicator clocks. Each circuit is fitted with an enclosed type time relay, switches and keys for controlling each circuit of secondary clocks, independent of the master clock.

The secondary clocks are of the flush type, with marble dials, 14 in. in diameter. All gears and pinions are cut from the solid and polished, and all parts of the movements are made of rustless material. All magnetic parts are heavily coppered and nickel-plated. The magnets are wound with double silk magnet wire; the clocks are provided with high-resistance shunt coil, and main movements designed for series operation.

The time stamps are placed as follows: One in the public office, superintendent's office and in the steward's office. They are operated by a relay on the secondary clock circuit. The time stamps are wound for 110 volts. The time stamps in the public office and the superintendent's office are connected to a separate circuit controlled from the main board in the administration building.

Special Lighting Unit in Operating Room and Amphitheater—Unit Is Supported on an Adjustable Arm so It May Be Swung Directly Over Operating Table.

Duplicate sets of storage batteries of the Exide lead type operate the clock system. There are 25 cells to each battery, one set operating the system while the other set is being charged. No. 12 rubber-covered wire is run from the storage batteries to the master clock and charging panel.

View in Laundry of Hospital Showing Electrically Driven Mangler and Ironing Machines—Five Electric Flatirons Are Operated from Separate Outlets in the Background.

The battery-charging switchboard is fitted with a flush type Weston voltmeter and ammeter, for showing the voltage and charging rates of both sets of batteries. The board is equipped with double-throw, double-pole, 25-ampere switches for charging and discharging of the batteries. There is a pilot indicator clock mounted on the board, for indicating the time of the entire system.

Electric Elevator Equipment.

The motors operating the 15 automatic electric passenger elevators are compound-wound machines rated at 3 hp. each, and are of a type especially designed to meet the severe requirements of such elevator service. They are connected directly to the worm shaft and, together with the worm gearing and drum, are mounted on a heavy continuous iron bed-plate.

The controller is so arranged that the shunt field is strengthened automatically before the brake begins to operate, this action taking effect gradually. Dynamic braking is used in stopping.

Each elevator operates to a height of 70 ft.; each car has a lifting capacity of 2250 lb. at 125 ft. per min. and can hold 13 people.

Safety guide grips are provided on each car which become operative whenever the maximum speed limit is exceeded in descending. The grips are operated by a rope passing through a clamping device automatically controlled by a centrifugal governor. This rope passes around the drum under the cage which revolves when the rope is clamped to operate the guide grips by means of right and left-hand screws. This device is arranged so that excessive car speed causes the governor to clamp the rope and turn the drum,

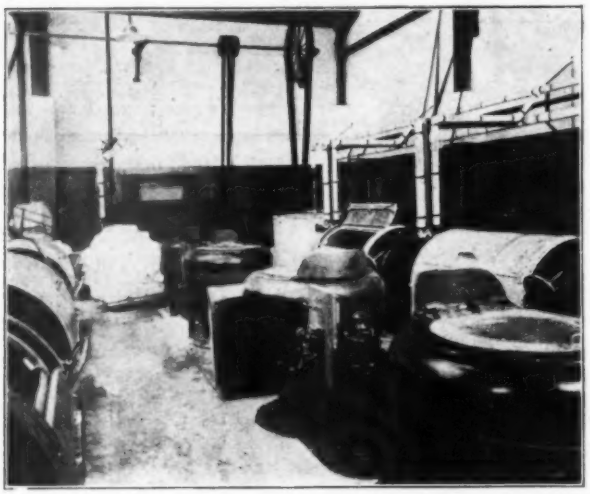
causing the jaws of the device to first grip the guides with sufficient pressure to check but not stop the car; further travel of the car increases the pressure on the guides until the car is brought to an easy stop. The safety guide grips are so arranged that they can be released from a handhole in the floor of the elevator car only after the automatic governor and rope clamp at top of the hatchway has been reset and the governor rope released.

The elevators are provided with automatic switches designed to bring the cars to an easy and gradual stop at the upper and lower limits of travel, independently of the operating device.

Electrical Equipment in the Laundry.

All the machinery in the laundry is electrically driven by direct-current 220-volt motors.

The solid curb extractors and the starch extractors



View in Another Part of Laundry—Group of Electrically Driven Washing Machines and Extractors.

have motors operated by 3-hp. and 1-hp. motors, respectively, each securely fastened to the base of the machine casing. The speed of the basket of the starch extractor is 800 r.p.m. A 15-hp. motor operates a lineshaft for the tumblers and washing machines.

A 1-hp. and a 1/5-hp. motor located on the ceiling of the dry room operate the conveyor chain and circulating fan with which this room is equipped. The circulating fan is located immediately below the ceiling. The framework carrying the track for the chain and all the mechanism for driving same is constructed of heavy cast iron bolted together and tied with ½-in. rods. The traveling link chain is supported by hangers with sheaves running in a grooved track, the chain being driven by a gear drive, controlled by a clutch and a rod at either side of the dry room.

The main mangle machine is operated by a 3-hp. motor located on a cast-iron base attached to the frame of this machine and geared direct. This machine is provided with a variable-speed control and with both manual and automatic stops. The feeding device is equipped with an automatic safety stop. All exposed gears are shielded. Another mangle machine is operated by a 1-hp. motor similarly located.

A 7½-hp. motor runs a lineshaft for the body ironers and steam collar and cuff ironers. The shirt-bosom ironer is operated by a 1-hp. motor direct-connected to the machine, which is equipped with a transmission friction clutch so constructed that it is not necessary for the motor to be reversed when the machine is in operation. Five electric flatirons are used for hand ironing; each has a separate wall receptacle, switch and pilot light.

Refrigerating and Other Electrical Equipment.

In the main power plant there is a horizontal ammonia compressor running at 70 r.p.m. and with a capacity of 20 tons of refrigeration per 24 hours; from it is operated a brine system of circulation to the main refrigerators in the kitchen, butcher shop and cold-storage rooms, and also to the ice-making rooms. This compressor is operated by a 220-volt, 600 r.p.m., 35-hp. compound-wound motor. The brine-circulating pump is of the horizontal duplex type, motor-driven and direct-connected.

There are three ice-making machines, one located in the main power plant and operated by a 15-hp. motor, also one in the Isolation, and one in the Tubercular Hospital, each operated by a 5-hp. motor.

The following equipment is operated by 220-volt motors in the kitchen and bakery: meat cutters, potato peelers, dough-mixers, meat and vegetable choppers, vegetable peelers, dishwashers, coffee grinder, and numerous ventilating fans, these fans being operated by 3-hp. motors. There are 8 Blaisdell vacuum cleaning machines in the institution, each belt-driven by a 3-hp. motor.

There are numerous surgical instruments operated by motor, such as saws, cauterizers, etc. All equipment in the dental department is motor-operated. Throughout the hospital laboratories there are centrifuges that are motor-driven. The bacteriological building is equipped exclusively with motor-driven devices, such as vacuum machines, compressors and centrifuges, also many heaters, ovens, etc. In the pathological laboratories there are high-frequency and medical coils; these are also found in the main wards. In the fluoroscopic room, the fluoroscope set is operated on 220 volts direct current with a mercury interrupter. The distribution of the high-tension current to the tubes is by means of an overhead trolley system, which enables the different apparatus to be moved to different parts of the room. There is an X-ray machine for taking plates, which is supplied from 220 volts alternating current; the high tension is rectified on a commutator run by a synchronous motor. There is also the other usual X-ray equipment.

All electrical equipment in the institution is under the direct supervision of Charles Long, who is chief engineer of the plant.

BRITISH SUBMARINE CABLE WORK DURING THE WAR.

The full story cannot yet be told of the remarkable achievements of submarine telegraph cable-laying and repairing authorities during the past five years. Part of it, however, was related by the Earl of Selborne, chairman of the Telegraph Construction & Maintenance Co. in London on February 27. In addition to manufacturing 20,000 miles of trench telephone cable, mostly with several conductors, the company made 19,000 miles of submarine cable and its ships were actively engaged, generally on most dangerous work, laying, repairing and diverting cables. The cable-steamer *"Telconia"* made 75 repairs to cables and laid 24 new ones around the English and Irish coasts. She and the *"Colonia"* were several times in close proximity to German submarines but thanks to naval protection both ships came through without loss.

Radio Transmitters of Synchronous Rotary Spark-Gap Type

Second of Three Articles on Design of This Type of Radio Transmitter—Use of the Vector Diagram for Analyzing Test Results and Thus Aid in Proper Design

By MILLARD C. SPENCER

HAVING, in the first part of this article, developed the current and voltage relations of the various parts of the transmitter circuit and shown them graphically by means of a simple vector diagram, we will undertake in this second part an analysis of the results of tests on radio transmitters by applying the graphical method already described. The actual design details will be taken up in Part 3.

PART 2—TESTS.

The application of this vector diagram in analyzing the results of tests made on radio transmitting apparatus can, perhaps, best be explained by showing its application in a few specific cases. For this purpose the results of a number of tests made on a radio transmitter set consisting of the following will be used:

Generator.—The generator used for these tests was an inductor type machine having an output of 250 watts and a current capacity of 2.75 amperes. During these tests the generator was driven at a speed which gave a frequency of 1330 cycles per second. The no-load saturation curve for this machine at this speed is given in Fig. 4. The synchronous impedance was equal to 105 ohms and the resistance of the armature winding, at the operating temperature of the machine, 9.5 ohms. (For the method used in obtaining the generator characteristics see the article entitled "Characteristics of the Inductor Type Generator," ELECTRICAL REVIEW, April 27, 1918.)

Transformer.—The transformer was of the closed-core type having, in comparison with the generator, very low resistance and leakage reactance. The transformer impedance can therefore, in this case, be neglected without introducing any serious error into the results. The transformation ratio was 26 to 1.

Rotary Spark Gap.—The rotary spark gap, which was of the synchronous type, was mounted on an extension of the generator shaft. The number and spacing of the points on the spark-gap rotor was such as to give one spark every fourth half cycle, instead of one spark every half cycle as customary when using a 500-cycle generator. The spark frequency was therefore 665 per second instead of the usual 1000 per second. The writer has found that, at least in radio transmitters of small capacity, a high-frequency generator with a synchronous rotary gap giving only one spark per cycle or even less (that is, one spark every third or fourth half cycle) gives considerably more stable operation and is less sensitive to voltage and frequency variations of the generator than a transmitter giving one spark every half cycle.

Oscillation Transformer.—The inductance of the primary winding of the oscillation transformer was exceedingly small at the generator frequency and will therefore be neglected.

The apparatus described above was connected up, according to the diagram of Fig. 5, with suitable instruments for measuring the current, voltage and power in the various parts of the circuit. Readings taken with set in normal operation were as follows:

Capacity of condenser $C = 0.002$ microfarad.
Generator field current $I_f = 0.25$ ampere.
Generator load voltage $E_1 = 220$ volts.
Generator load current $I = 2.6$ amperes.
Generator output $W = 250$ watts.

As indicated in the diagram of Fig. 5, no regulating reactance coil was used, the transformer being connected directly to the generator terminals. Furthermore, since the impedance of the transformer is to be

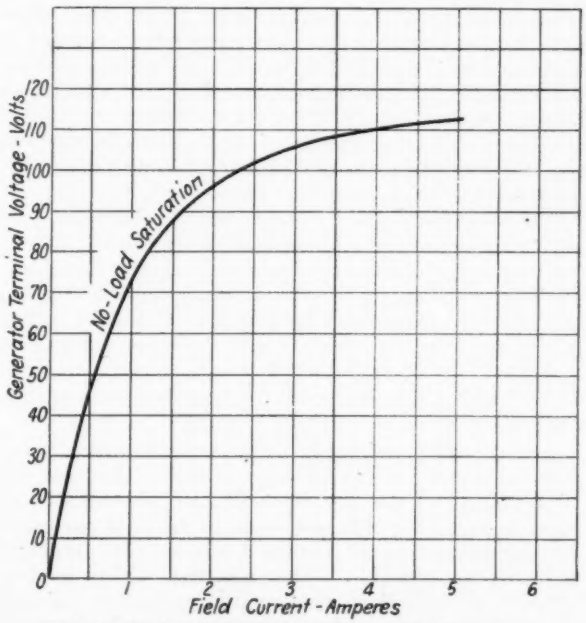


Fig. 4.—No-Load Saturation Curve of Generator.

neglected, as mentioned above, the equivalent circuit of Fig. 2 reduces to that shown in Fig. 6 and the vector diagram of Fig. 3, corresponding to the circuit of Fig. 6, reduces to that shown in Fig. 7. The actual numerical values corresponding to this diagram may be determined from the above readings as follows:

Generator armature resistance $R_g = 9.5$ ohms.
Generator synchronous impedance $X_g = 105$ ohms.
Equivalent load resistance $R_1 = W/I^2 = 250/(2.6)^2 = 37$ ohms.

$$OA = IR_g = 2.6 \times 9.5 = 24.7 \text{ volts.}$$
$$AB = IX_g = 2.6 \times 105 = 273 \text{ volts.}$$
$$OB = E_g = \sqrt{(IR_g)^2 + (IX_g)^2} = \sqrt{(24.7)^2 + (273)^2} = 274 \text{ volts.}$$
$$BG = IR_1 = 2.6 \times 37 = 96.2 \text{ volts.}$$

Since the transformer was connected directly across the generator terminals and the transformer impedance drop is to be neglected, $BH = E_1$ is equal to the generator terminal voltage of 220 volts. Then,

$$GH = IX_c = \sqrt{(E_1)^2 - (IR_1)^2}$$
$$= \sqrt{(220)^2 - (96.2)^2} = 198 \text{ volts.}$$

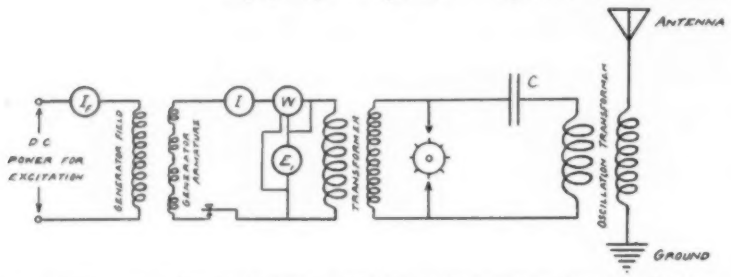


Fig. 5.—Circuit Diagram Showing Location of Instruments Used in Testing Radio Transmitter.

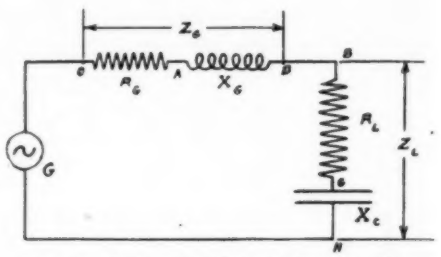


Fig. 6.—Equivalent Circuit for the Transmitter of Fig. 5.

By drawing in the vector diagram as indicated in Fig. 8, it is seen that the internal generated voltage must have been equal to

$$E = \sqrt{(IR_g + IR_1)^2 + (IX_g - IX_c)^2}$$
$$= \sqrt{(24.7 + 96.2)^2 + (273 - 198)^2}$$
$$= 142.5 \text{ volts.}$$

From the saturation curve of Fig. 4 it is found that a field current of 0.16 ampere is required to generate a voltage of 142.5 volts on no load. The difference between 0.16 and the measured field current of 0.25 ampere is the field current required to overcome the demagnetizing effect of the load current flowing through the generator armature winding.

The true power-factor of the system is equal to the cosine of the angle $HOI = (24.7 + 96.2)/142.5 = 0.847$ or 84.7% *lagging.*

The apparent power-factor as determined from the voltmeter, ammeter and wattmeter readings is $\cos\theta = 250/(220 \times 2.6) = 0.437$ or 43.7% *leading.*

That the load current is actually leading and not lagging with respect to the generator terminal voltage may be proved by constructing a vector diagram as indicated in Fig. 9, in which this current is assumed to be lagging. In this case the required internal generated voltage E must then be equal to

$E = \sqrt{(24.7 + 96.2)^2 + (273 + 198)^2} = 485$ volts.

The saturation curve of Fig. 4 shows that no such high voltage as this could possibly be generated by the machine used for this test, even if the field current of the generator were increased up to the saturation point of the machine. The fact that, with a field excitation of only 0.25 ampere this generator was able to send a current of 2.6 amperes through the transformer of the set proves that the load current must have been leading with respect to the generator terminal voltage.

It is interesting to note that, as shown in Fig. 8, the voltage at the terminals of the generator, $BH = 220$ volts, was actually higher than the internal generated voltage of the machine, which was equal to 142.5.

The above test may also be used to determine the relation between the apparent and the effective value of the condensive reactance X_c, that is, to determine the value of the constant k mentioned in Part 1. The value of the capacity C (Fig. 5) expressed in primary terms equals 0.002 multiplied by the square of the ratio of transformation of the transformer—that is, its capacity in microfarads is

$$0.002 \times (26)^2 = 1.352 \text{ mf.}$$

The apparent value of the condensive reactance is obtained by substitution in equation 2, Part 1, as follows:

$$X_{cp} = 10^6/(2 \times \pi \times 1330 \times 1.352) = 88.5 \text{ ohms.}$$

As determined above, $IX_c = 198$ volts; therefore, the effective value of the condensive reactance equals

$$X_c = 198/2.6 = 76.0 \text{ ohms,}$$

and hence from equation 3, Part 1, the value of

$$k = X_c/X_{cp} = 76/88.5 = 0.86.$$

The value of this constant k seems to vary considerably with the design and adjustment of the radio apparatus, falling in some cases as low as 0.55. For transmitting sets designed to give one spark per cycle —that is, one spark every other half cycle—a fair average value for this constant seems to be 0.60. For sets giving one spark every third or fourth half cycle this constant, in general, seems to be somewhat higher.

A second example will now be given showing the application of this vector-diagram method in the locating of faults in an incorrectly designed transmitting set. For this test the same apparatus and connections were used as shown in Fig. 5, with the exception that the capacity of the condenser C was changed to 0.001 mf. When this change was made the radio output of the set fell way off, the character of the

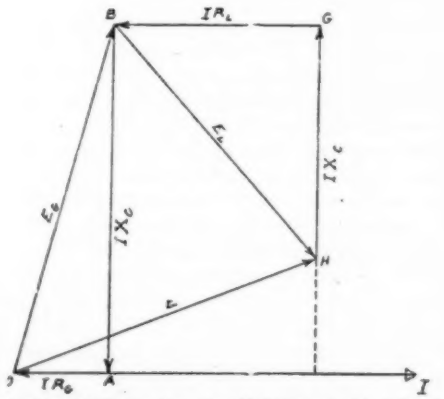


Fig. 7.—Vector Diagram for the Equivalent Circuit of Fig. 6.

spark at the rotary gap changed and became more of an arc, the note became very poor, and it was found impossible to obtain satisfactory operation of the set even by readjusting the generator voltage. The following readings were taken while thus operating:

Capacity of condenser $C = 0.001$ mf.
Generator field current $I_f = 0.22$ ampere.
Generator load voltage $E_1 = 210$ volts.
Generator load current $I = 1.6$ amperes.
Generator output $W = 128$ watts.

The values for the vector diagram of Fig. 10 are obtained as follows:

$R_1 = 128/(1.6)^2 = 50$ ohms.
$IR_g = 1.6 \times 9.5 = 15.2$ volts.
$IX_g = 1.6 \times 105 = 168$ volts.

$E_g = \sqrt{(15.2)^2 + (168)^2} = 169$ volts.
$IR_1 = 1.6 \times 50 = 80$ volts.
$E_1 = 210$ volts.
$IX_c = \sqrt{(210)^2 - (80)^2} = 195$ volts.
$E = \sqrt{(15.2 + 80)^2 + (195 - 168)^2} = 99$ volts.

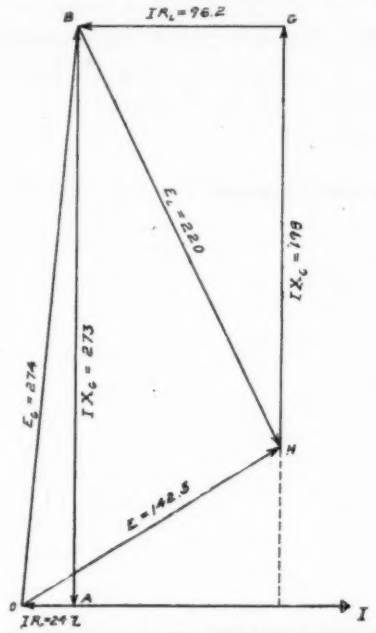


Fig. 8.—Vector Diagram for Transmitter of Fig. 5 in Normal Operation—Condenser C = 0.002 mf.

The reason for the poor operation of the set is seen at once from the vector diagram of Fig. 10. The point H falls below the line OI and the current I is leading with respect to the internal generated voltage OH. The requirement for the satisfactory operation of a radio transmitter, that the current shall be lagging with respect to the internal generated voltage, is therefore not fulfilled.

In case that it was necessary to use the small condenser (0.001 mf. capacity), in order to obtain the desired wave-length, the vector diagram of Fig. 10 shows how the set might be modified in order to obtain satisfactory operation with this condenser. For instance, the ratio of transformation of the transformer might be increased sufficiently to raise the point H above the line OI; or a reactance coil might be connected in the circuit at the point B which would serve to raise the whole triangle BGH. Connecting a reactance coil in the circuit would probably increase the required internal generated voltage, but by means of the diagram the value of the voltage required could readily be determined and the saturation curve for the generator would show whether or not this voltage could be obtained.

In order to show the effect of too large a capacity for the condenser C (of Fig. 5) a third test was made with this capacity increase to 0.003 mf. A set of readings taken under these conditions were as follows:

Capacity of condenser $C = 0.003$ mf.
Generator field current $I_f = 0.25$ ampere.
Generator load voltage $E_1 = 170$ volts.
Generator load current $I = 2.75$ amperes.
Generator output $W = 216$ watts.

A vector diagram, developed in the same way as outlined above for the first two tests, is given in Fig. 11 for this test. A comparison of these test results with those obtained with a condenser capacity of 0.002 mf. shows that by increasing the capacity of the condenser to 0.003 mf. the output which could be obtained from the generator, with the same field excitation, was not only not increased but was actually decreased. The reason for this is clearly seen by comparing the vector diagram of Fig. 11 with the diagram of Fig. 8. These diagrams show that in the case of the test made with the condenser of 0.003 mf. capacity the lag of the current behind the internal generated voltage was much greater than in the case of the test made with the 0.002-mf. condenser. The decrease in the output of the generator in the case of the test with the 0.003-mf. condenser was therefore caused by the decrease in the true power-factor of the transmitter.

(To be continued.)

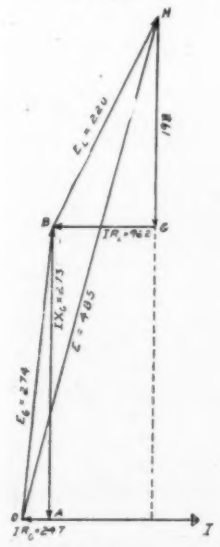


Fig. 9.—Vector Diagram for Lagging Load Current.

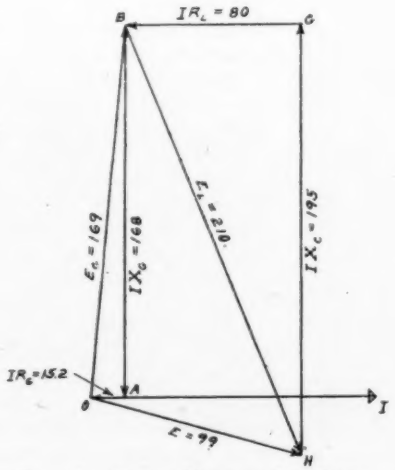


Fig. 10.—Vector Diagram for Transmitter of Fig. 5 With Condenser C = 0.001 mf.

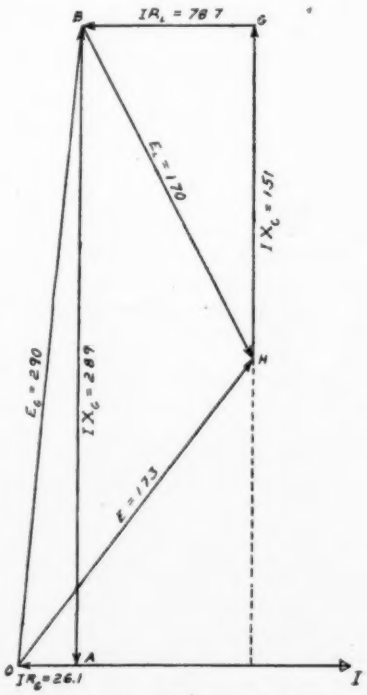


Fig. 11.—Vector Diagram for Transmitter of Fig. 5 With Condenser C = 0.003 mf.

Development of Submarine Detector and Some of Its Exploits

Brief Report of Scientific Research and Perfection of Sensitive Sound Detector—Thrilling Account of Its Use in Combating the U-Boats

By BREWSTER S. BEACH

THIS article is the first account of the development by American scientists and engineers of a highly successful submarine detecting device. It tells how this detector helped in removing the serious menace of the U-boats. Closely guarded during the war, the facts are now divulged so that the achievements of American electrical science may be appreciated. For several obvious reasons the technical details cannot now be made public.

The facts are here presented by a member of the publicity staff of the General Electric Co., to the resources and activity of which concern the success of the undertaking, it is said, was very largely due.

AMERICAN naval experts state with conviction that if the war had lasted six months longer German submarine warfare would have been impossible. Back of their belief lies a story shrouded in the secrecy of the censorship. The cessation of hostilities now makes it possible to divulge some of the details for the first time.

The doom of the submarine may properly be said to have been signed and sealed on a historic day in October, 1917, off the coast of Cape Cod, Mass., when a notable group of American engineers and naval officers completed the first successful test of apparatus which, up to now, has been the most carefully guarded military secret of the Allies—the submarine detector.

When the United States entered the European conflict, the greatest military problem confronting the Allied nations was a successful solution of the tremendous difficulties caused by the interruption to shipping by German submarines—a condition which had been rapidly growing more serious since the inauguration of Teutonic "frightfulness."

On the outbreak of hostilities, Secretary of the Navy Daniels appointed a special board to consider ways and means to meet this submarine menace and overcome it.

Two groups of engineers and scientists were formed, one at New London, Conn., where the Navy had established a submarine base, and another at Nahant, Mass., where for many months experiments were carried on to develop some device to locate submarines under water.

The General Electric Co., Schenectady, N. Y., played a prominent part in the activities at the Nahant station in co-operation with the Submarine Signal Co., of Boston. The latter had, up to this time, been the only concern which had made a study of the propagation and reception of sound waves in water and it very generously offered to disclose the results of its research in order to assist in the development of a suitable submarine detector, notwithstanding the fact that it realized by so doing it was disclosing much confidential information which had been secured through years of work and the expenditure of many thousands of dollars.

The work at Nahant was begun and carried on in conjunction with experimentation in the research laboratories of the General Electric Co. under its director, Dr. W. R. Whitney, assisted by Drs. Irving Langmuir and W. D. Coolidge and other research scientists. Experts from the Western Electric Co. joined this group later.

Col. R. A. Millikan, head of the Department of Physics of the University of Chicago and chairman of the Physics Committee of the National Research Council, with Prof. Max Mason and others, began a separate undertaking to accomplish the same object at New London, and the activities of the two groups were later co-ordinated.

In the meantime, losses by submarine sinking were increasing and in April, 1917, tonnage destroyed amounted to 874,000 tons. It was evident that something would have to be done at once.

The General Electric Co. bent all its energies to the task. Its research laboratories were mobilized on a war basis and the best talent of the company assembled. The entire works was put at their disposal. If they desired a man working on another job, he was theirs instantly for the asking. If a casting was desired quickly, the foundry dropped everything to rush the job to completion. Feverish activity under high tension marked each successive step of progress.

Scientific experiments gradually passed the experimental stage and then the Navy Department, through Dr. Whitney, who was a member of the Naval Advisory Board, placed its organization at their disposal for making the practical tests which followed.

Scientific commissions from the Allied countries now visited the United States unknown to the general public. They laid bare everything which Allied brains had done to stop the submarine. They explained the merits of the devices in use, their advantages and disadvantages, their manufacturing and scientific resources, what progress had been made and what it was hoped to accomplish in the future. They laid their problems before the Naval Consulting Board in Washington; they went to Schenectady, Nahant and New London. Consultations and conferences followed one another in rapid succession.

"We must discover," they said, "more effective means to combat the German undersea warfare and we must do so at once. Every instant counts. France need sub-chasers like yours by the thousands. Every day lost means more destruction to life and property."

Special reports from the war zone supplied by

Admiral Sims and the British Admiralty were gathered, forwarded to the laboratories and carefully analyzed.

"What was the average cruising radius of a submarine? What was the condition of the sea bottom over which they operated? Did the submarines enter the Atlantic to the north of England and through the Irish Sea or did they sail through the English Channel?" These and a score of other questions were asked and answered.

More experimental stations were established—one on the Mohawk River near Schenectady and another on the Erie Canal.

Meanwhile in the guarded laboratories experimentation still continued. "Progress" was the one word which emanated from behind the closed doors—always progress.

At last, 12 weeks after experimentation had begun, the engineers had perfected an instrument which they believed would meet all demands. A new device for detecting submarines—a development of the American mind and one of this country's greatest contributions to the war had resulted from their labor.

The detector is based on the principle of sound-wave transmission through the water, and depends for its direction-getting qualities on the peculiar and heretofore little understood faculty of the human ear to detect the direction of sound by the shifting of sound from one ear to the other.

So important was the human equation in the proper manipulation of the instrument that one of the first things done was to establish a school for submarine listeners at the Nahant station, which was attended by a score of Uncle Sam's naval officers and enlisted men. Among the first students was a group of French sailors.

The apparatus, variously termed detector, listener or listening device, was first designed to be hung overboard amidships, below the water line. The observer was stationed on deck. Later the instrument was fastened to the hull of the vessel and the observer took his position within the hold, the connections leading through the side of the ship.

It was soon discovered that the rocking of the boat in heavy weather seriously affected the range of the device. This, in addition to the slapping of the waves against the ship's sides interfered at times with the operator's observations, but these obstacles were overcome.

During the experiments it was found necessary to stop the engines in order that accurate observations could be taken. This led to the elimination of extraneous sounds and added considerably to the effective range of the instrument. For heavy-weather conditions, a towing device, or trailer, was invented which dragged the listener through the water astern.

The engineers were now ready to test the practicability of the device "under fire," and further experiments were carried out under conditions as nearly as possible approaching those in European waters.

The navy submarine station at New London dispatched a flotilla of underwater craft and a squadron of submarine chasers to Boston waters. The chasers were equipped at Nahant with submarine detectors and practice began in real earnest.

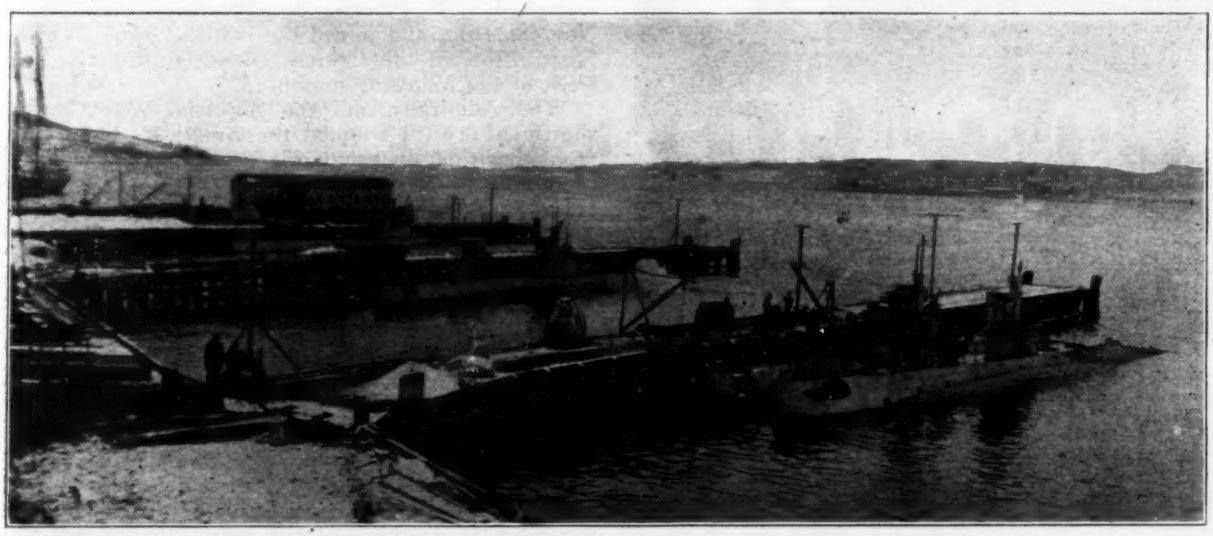
In spite of it all, initial experiments proved slow of entirely satisfactory developments until the fall of 1917, when it was decided to go out to sea off Cape Cod, for more thoroughgoing tests.

The sea was clear of craft as far as the eye could see—yet the operator with his ear to the detector distinctly heard a vessel gradually approaching. The captain from the bridge eagerly scanned the horizon with the ship's glasses, but nothing was in sight.

"Send a man aloft with powerful glasses," he commanded. "The detector has picked up a craft three points on our starboard bow." The sailor returned. "Nothing in sight, sir." "I'll go aloft myself. That boat sounds as if it were very near. Why, we can hear her engines as clearly as if she were alongside." Puzzled, the captain returned from the masthead after a disappointing vision of a calm and perfectly clear sea. "How's she coming?" shouted the first lieutenant down the hatchway. "Heading straight for us, sir. Sound getting louder every minute."

There was nothing to do but wait. The captain pulled out his watch and sat down. Fifteen minutes—half an hour—an hour—ticked on. "Ship ahoy," came from the masthead. "Where away?" "Two points on the starboard bow, sir. Looks like she was heading this way."

This vessel had been detected by sound waves



(Photo by International Film Service Co.)

Submarine Base at New London, Conn., Where the National Research Council and Naval Engineers Developed and Experimented with Submarine-Detecting Devices—Headquarters of the New London Group of Scientists.

traveling through the water, her course and speed had been accurately charted and her exact position within one point of the compass had been determined more than an hour before the vessel itself had become visible over the horizon.

"It's almost perfect!" said one of the naval engineers in an undertone. The tension under which they had worked for hours suddenly relaxed. The ship's crew gathered in groups to talk it over. There was not a dissenting opinion. The secret of detecting the presence of an unseen vessel had been solved!

The ships steamed back to Nahant. A long-distance call was put in for the navy submarine base at New London: "Rush three submarine chasers to Nahant at once." In due time they appeared. The party started out again, were joined by submarines from the Boston Navy Yard, and anchored off the Massachusetts coast line.

One submarine at a time submerged. The sub-chasers equipped with detectors followed her every movement, charted her position, reported to each other by special signal devices and when everything was in readiness rushed to a spot just over the sub. Dummy depth bombs were dropped. The submarine rose to the surface. She had been within a few feet of her charted position.

And now the apparatus was about to demonstrate its most valuable service. A series of practical tests proved beyond the possibility of a doubt that the detector could successfully differentiate between the sounds made by surface craft and the sub. The submarine noises were distinctly peculiar to itself and the instrument, translating this sound to the trained ear, brought home the message.

The Victor Talking Machine Co., Camden, N. J., was now called upon for its contribution to the invention. Phonograph records of the various sounds heard by the observer were made and cataloged, thus preserving a complete record of the accomplishment of the device. The records were used principally in training students to identify the submarine noises and detect the difference between submarine and surface craft.

(Photo by General Electric Co.)

Experimental Station at Nahant, Mass., Where a Majority of the Practical Work in Connection with the Development of Submarine-Detecting Devices Was Successfully Undertaken and Completed.

Further tests were made. Shore listening stations were set up. During the night trained men sat and listened to vessels going in and out of Boston harbor. The navy attempted to slip a submarine through the harbor entrance one night but the craft was detected at once and a full report of her activities was sent to headquarters a few hours later. Not a ship could enter or leave Boston without being heard. In fact, so sensitive was the instrument that trained listeners could accurately identify a ship by name, once having heard her, the engine characteristics of different ships being plainly audible and distinctive!

Another important test took place in Long Island Sound, in which a special board of naval experts and invited guests boarded a sub-chaser equipped with the device and undertook to follow a submarine for several hours. This was accurately done, even when the latter vessel deviated several miles from its prearranged maneuvering zone. In the meantime another submarine that happened to enter the zone was detected at a distance far beyond visual observation.

The research laboratories of the General Electric Co. were still kept busy adding new perfections to the apparatus. A special station was equipped on the Mohawk River at Schenectady, and when the river froze over and interferred with the work, one of the engineers proceeded to Key West to continue investigation.

Finally, after months of practical operation, an instruments that was considered satisfactory was put into quantity production at the Lynn, Mass., works of the company. Thousands of detectors were subsequently manufactured there. A special representative was then sent to Europe to keep in touch with developments.

When the submarine detector had been turned out in sufficient quantity, the Navy Department believed that the Allies should get the benefit of the invention at once. A special service party, in charge of Capt. R. H. Leigh, of the Bureau of Steam Engineering, was formed to take samples of the apparatus abroad and test it under actual conditions before the British admiralty. The instrument was likewise demonstrated to the French and Italian navies. The party consisted, besides Capt. Leigh, of Lieut. Carter, U. S. N., Ensign Welch, U. S. N. R. F., six enlisted men, C. E. Eveleth, C. F. Scott, and T. P. Collins of the General Electric Co., representing the Nahant group, and W. L. Nelson, of the Western Electric Co., who was connected with wireless development. They sailed Nov. 22, 1917, and joined the British Grand Fleet at Scapa Flow in the Orkney Islands during the first week of the following month.

The Admiralty and the Supreme War Council shortly afterward adopted the American device and from that time on submarine patrol work was revolutionized.

Defensive tactics which had been employed since 1914 were now no longer the sole reliance. The war was carried into the enemy's territory. Fighting ships, instead of patrolling the steamship lanes looking for a stray "sub" to poke its periscope above the waves, were augmented by submarine chasers equipped with listening devices, and hunted the submarine in its underwater lair.

Up to this time the British had been frankly disappointed in results. It had been a rare thing for a submarine chaser to actually see a submarine. Days would go by without sight of one. Yet sinkings continued to multiply, tonnage decreased alarmingly and the rates of destruction and construction constantly approached the danger point. It was apparent that if an improvement in this situation could not be effected the Allies faced privation, if not actual starvation, and

any material help from America either in the form of men or supplies would be impossible.

At this time the use of nets had proved a failure. U-boats had been passing through the English Channel at will, laying mine fields off the principal British ports and in general having things pretty much their own way. The depth charge was being brought to a high state of perfection. Gradually various means of combating the submarine were evolved and put in operation. The principle of these was the extension of the convoy system; establishing great areas of mine fields; use of submarine detection devices on surface craft and Allied submarines, and the extension of visual patrols from aircraft. In fact, Allied patrols, equipped with submarine detecting devices, now began to assume great importance, so that at the time the armistice was signed they were daily becoming more and more effective.

It was estimated that in December, 1917, two to five enemy submarines passed through the English Channel daily. After July 1, 1918, only one submarine is known to have done so. In June the Admiralty estimated that one out of every four submarines was destroyed. In October the ratio had been increased to five out of every twelve. By this summer British and American naval officers believe three out of every four submarines would have been destroyed. These results were largely due to the perfection of listening devices.

Hundreds of British craft and most of the American forces were now equipped with the submarine detector. Many French and Italian vessels were also using it. The submarine hunt was on.

Both Mr. Eveleth and Mr. Scott joined the combatant Allied forces to supervise the detector's use under battle conditions, while Capt. Leigh, who was appointed by Admiral Sims to take charge of anti-submarine warfare, himself spent many nights on the British trawlers and sub-chasers in the channel and partook actively in the campaign of submarine hunting which followed.

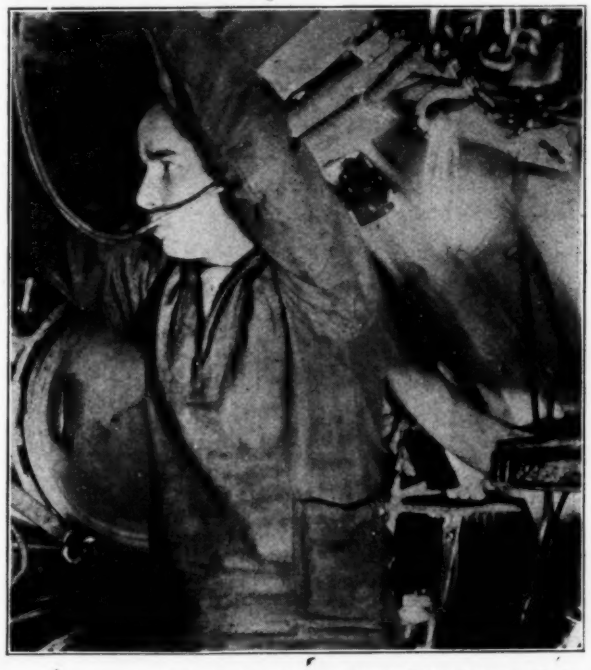
All the navigating charts of the waters around the British Isles, like the English Channel, North Sea and Irish Sea, where the submarine warfare was most active, were divided into squares, properly lettered and numbered for quick reference as to positions of torpedoed ships or enemy submarines sighted by surface craft or airplanes.

The special party under Captain Leigh took over about ten tons of detection devices, and had also worked out the tactics necessary for the detection, pursuit, attack and destruction of the enemy submarines. "A request was made of the British Admiralty for the use of three boats capable of making 18 knots, on which this apparatus could be installed and a demonstration made," said Mr. Scott. "No vessels of this speed were available so we were forced to accept three fishing trawlers of 9 to 10 knots speed.

"These trawlers were fully equipped with all the American submarine-detecting devices, radiotelephones, etc., at Portsmouth, England, and on Dec. 30, 1917, we steamed out of the harbor for our first real patrol in English waters. The channel lived up to its reputation of being the roughest body of water for its size in the world.

"The day after New Year's we received a wireless from an airship that a submarine had been sighted. We steamed over, got our devices out but couldn't hear a thing. Another message from the airship changed the sub's position, so we altered our course and obtained a clear indication from the listening device. The Hun was moving slowly up the channel submerged.

"We gave the 'P' Boat a 'fix' (cross bearing) on the spot where our indication showed the submarine to be. She ran over the place, dropping a 'pattern' of depth charges and soon we began to see tremendous



(Photo by International Film Service Co.)

Sailor in Hold of a Submarine Listening (by Means of Detector Device) for Enemy Craft.

amounts of oil rising to the surface. Evidently our first experience was to be successful. How successful we did not learn until afterward. A trawling device had been developed which indicated whether contact with a submarine had been made.

"After the oil came up we got out our trawling device and ran over the area for about an hour and finally got an indication. We threw over a buoy to indicate the spot and anchored for the night, as it was getting dark. Next morning we trawled again and got another within a hundred yards of the buoy. We had destroyed a submarine in our first test and the sub was given out by the Admiralty as a 'probable.'

"The British, after we came back, thought so well of the device as demonstrated in the first test that many were ordered from the United States. We had taken over detailed drawings of all the apparatus and pointed out to them that if the shipping facilities were such that some delay might occur in getting American-made devices overseas that they could build it themselves."

Important conferences were held with the Lancashire group at Harwich in which Mr. Eveleth took part in assisting the British to get the apparatus into immediate production on a large scale. The United States officials made every effort to extend all possible means of co-operation and assistance to scientific committees and the Admiralty. Mr. Eveleth then went back to America to work on the development of a new device for locating the position of enemy submarines while at rest at the bottom of the ocean. He was on the point of returning when the armistice was signed.

"Our work for three months after this," continued Scott, "was supervising the manufacture of the devices

in various shops in England and about May, 1918, our own ships began to come over with all these devices installed. They were also equipped with radio-telephones, depth charges and 'Y' guns. A 'Y' gun is a casting with two arms forming a Y. Each arm holds a depth bomb in an arbor. The depth charges are shot out of the 'Y' gun by means of an auxiliary powder charge to a distance of 100 feet. The ability

(Photo by General Electric Co.)

Trailing Listening Device Off Stern of Sub-Chaser in Foreign Waters.

to place charges from the beam as well as from the stern gives a better pattern in making an attack. Where three ships, say 400 yards apart, are going over the ground where a sub has been located, the use of the 'Y' gun permits of a larger area being covered.

"When the American submarine chasers began to arrive they were assigned to the channel where the German submarine activities were greatest and we did a good deal of patrolling there in the early spring. The second lot of chasers was ordered to Corfu in the Adriatic. We went down to Corfu in June.

"We had 36 chasers based in a little bay on the Island and the barrage of boats extended across the Straits of Otranto, a distance of about 40 miles. The chasers were operated in units of three, which on patrol kept about one mile apart. A distance of five miles was kept between units. Conditions in the Adriatic were ideal for hunting submarines. The water was very deep, ranging from 400 to 600 fathoms, which meant that the submarines when hard pressed could not seek shallow water as was their custom in the English Channel and the North Sea. Due to less shipping traffic in these waters there was practically no sound interference which made for very good listening.

"The main Austrian submarine bases were at Pola, at the head of the Adriatic, and Gattaro, farther down the coast. The German submarines leaving Pola were obliged to go through Otranto Straits to get to the Mediterranean, and once through they had things practically their own way, as there were very few patrol boats in the Mediterranean. The tonnage sunk during the first three years of the war shows the condition that existed before the Otranto barrage was put in effect.

"Our submarine chasers while on barrage were constantly in sound contact with enemy submarines, especially at night, as they usually attempted to get through during the dark hours. They would run down on the surface at their maximum speed and could be heard for an hour or two before they came to our line. The sound between an oil engine and an electric motor is so distinctive that it was comparatively easy to tell when they changed from one to the other, which was necessary as soon as they submerged. As they knew approximately where our line was they invariably submerged two or three miles before they reached the line.

"The course of the submarine was plotted to scale by the flagship of a unit from bearings given to it from the other two boats and also from its own bearings. When the submarine had approached sufficiently close, the unit was gotten under way and maneuvered into position for attack. The attack was usually made when the submarine was 400 or 500 yards ahead and all three boats of a unit, steaming full speed ahead, would lay a pattern of depth charges over the area where the plotted position showed the submarine to be. Many successful attacks were made in these waters, one in particular being quite exciting.

"One of the ships in a unit heard what sounded like a submarine. In a few minutes all three listeners had picked him up and the bearing of his course was being plotted. The middle chaser, the flagship, was getting readings showing that the submarine was in a direct line astern and steaming toward her.

"The sound was very loud as if the sub must be very close. Suddenly the water began to slap the bottom of the boat, so that everyone could feel it; and the next moment the observer reported that his bearing on the submarine had changed from 180°, which was dead astern, to 3°, which was on our bows. The submerged submarine had passed directly under the center boat. All three boats were immediately gotten under way and the attack was delivered. After all the depth charges had been dropped, the ships were stopped and observations again taken. A propeller was heard to start up and ran for about 30 seconds; and then a crunching noise was heard. It was quite evident that the sub, having been put out of control, sank to the bottom and had collapsed due to the tremendous pressure at these depths. We went back to the spot the next morning and found an oil slick two miles long by 800 yards wide on the surface of the water.

"The British airplanes and dirigibles did excellent work in patrolling the waters where enemy submarines were in the habit of making attacks on transports and merchant ships, but were somewhat handicapped in not having detecting devices by means of which the direction taken by a submarine after it submerged could be ascertained. With a view to determining whether the American detector could be applied to such a ship, the Aviation Department of the Admiralty, early in May, 1918, arranged for us to have a trip on the 'North Sea No. 6.' The ship was one of the newest types of dirigibles, carried a crew of 16, and had the latest type of engines, steering gear, bomb throwers, cameras, etc.

"We flew from Chatham, England, out over the channel, where the ship was brought down near the water and tests made which showed that the detector could be used with good results. Lieut. Struthers, captain of the ship, pointed out a submarine periscope, which his trained eye had seen, although at a considerable distance. It was a friendly submarine, exercising and had a trawler near her to prevent being

bombed by any craft that might mistake her for the enemy. Later tests in France and England demonstrated the practicability of the detector for this type of aircraft.

"The addition of listening devices to all American submarines was of tremendous assistance to them when out on patrol. The American submarine base was at Berehaven, Ireland, and submarines operated from there off the west coast of Ireland on the lookout for U-boats. Up to the time that we entered the war, submarines, once they submerged below listeners' depth, were both blind and deaf. The development of the listeners for use with submarines gave them an added sense which they used constantly after they got into the war zone, and began on anti-submarine warfare.

"The submarine overseas was common enemy and the Allied submarines in all seas were attacked quite as much by their own patrol craft as by the enemy. Submarines used to come in reporting having been attacked by British or French destroyers, or aeroplanes, due to the rapidity of the attack, and due to their inability to get off a recognition signal in time to stop them."

Mr. Eveleth describes a peculiar incident which happened one early morning in the Mediterranean near the entrance to the Adriatic Sea. An enemy submarine had been caught in a net. A pattern of depth charges was laid around her and the trawler backed away to take an observation. One of the observers, who was operating the overboard device from his station on deck, felt a heavy object brush against the detector. A few minutes later he was dumbfounded to see a German sailor climb on board. He had evidently been thrown into the sea by the force of the explosion and saved himself by grasping the detector as he drifted through the water.

One of the most dramatic incidents occurred on the morning of Sept. 6, 1918. One account of the engagement says:

"At 1:25 o'clock unit No. 6 'fixed' (located by triangulation) a submarine directly ahead at a distance of 100 yd., immediately carried out three-boat barrage attack, each boat letting go three stern charges and 'Y' gun. Pattern laid symmetrically, thoroughly covering any possible maneuver of the submarine. Stopped and listened. No hearing for about 20 minutes. Then got contact. Distinct sound of submarine making noise as if shafts were badly bent. Also giving out squeaking sound. Submarine sounded as if having great difficulty in keeping propeller going. She stopped frequently. We followed. . . . Heard submarine hammering, squeaking, straining, running intermittently, apparently with great difficulty and for short periods.

"The second depth charge of this attack threw into the air a 50 to 60 ft. cylindrical black object about the size of a depth charge. . . . Another depth charge attack carried out. Submarine had gradually been making shorter turns for some time. . . . From this point on believe submarine bottomed and was never able to move except to start and scrape along the bottom a short distance. Noises indicated this."

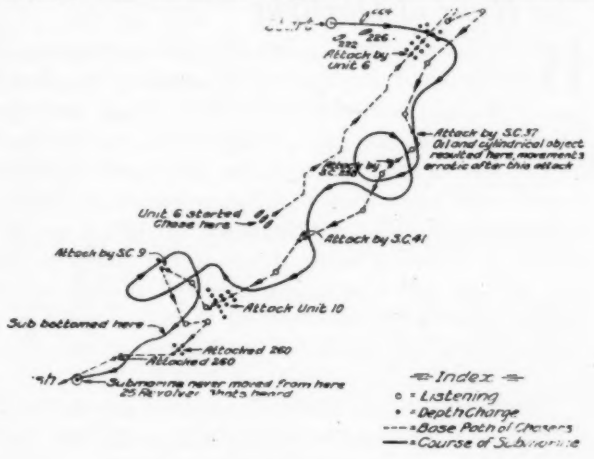
Word was then sent to Penzance for additional depth charges and a radio dispatched to the base for a destroyer post haste.

"Subsequent events," continues the report, "show that submarine never moved from this spot. Noises indicated repair. Occasional unsuccessful attempts to start motor . . . sounds rapidly becoming less frequent."

When morning came the submarine chasers and the destroyer which had been sent to their assistance gathered near the spot where the crippled submarine was resting on the bottom. Sounds of feverish activity within the submarine's hull were distinctly heard.

Suddenly there was dead silence—then 25 revolver shots rang out—3 first followed by 22.

"Taking into consideration all circumstances and events," continues the report, "conclude submarine



(Photo by General Electric Co.)

Chart Showing Operations Against German U-Boat, Based on Official Data Collected by Naval Officers During the Actual Engagement.

damaged externally, unable to start motor after repeated attempts. Unable to rise to surface and is on bottom in the vicinity. Reports of listeners substantiate this conclusion."

As a matter of fact, the British Naval Intelligence Department learned later that the crew of a German submarine had been lost in the English Channel about this very same time. The report as they obtained it indicated that the Hun boat had been trapped on the bottom and so seriously damaged she was unable to rise.

RATE INCREASES AT STOCKTON.

The Railroad Commission of California has authorized increased rates of charge for both gas and electric service supplied by the Western States Gas & Electric Co., Stockton division. The decision grants increases over surcharges allowed for the duration of the war and establishes the new rates on a permanent basis without surcharge features. This is the third rate increase allowed this Company since the start of the war.

RESULTS OF ELECTRIFICATION OF AN ENGLISH RAILROAD.

In the year 1913 local passengers carried on the London & Southwestern Railroad's suburban lines numbered 25,000,000. Two years later, before electrification, the number had fallen to 23,000,000, due largely to the inadequacy of the service rendered with steam power. During 1916 electric service was gradually brought into operation and the passengers increased to 29,000,000. In 1917, the number further advanced to 33,000,000. In 1918, as was explained at a recent meeting held in London, the total was 40,000,000, or 17,000,000 more than in 1915.

Editorial Comment

Making the Most of the Additional Hour of Daylight

BEFORE this issue of the ELECTRICAL REVIEW is in the hands of most of its readers the clocks will have been turned an hour ahead, and the second season of daylight saving will be on the way.

For the central stations the additional daylight means much more than merely a reduction in energy consumption for lighting purposes. It offers an opportunity for doing many things worth doing in the way of load and system improvement, as well as of finding other ways than lighting to make up for the revenue from lighting that is lost because of the extra hour of daylight.

Notwithstanding considerable pressure exerted from several quarters to repeal the daylight saving law, the law remains. Last year it proved its worth as a time, fuel, health and money saver. It is to be hoped that it is now firmly established as a sound and sane measure. Central stations, street railways and other public utilities affected may, therefore, in looking ahead, plan to make the most of the seasonal daylight saving by adopting methods of operating. Economical boiler room operation, the flexible manipulation of boilers, the reduction of banked fires to a minimum and the adoption of high ratings offers a field for considerable economies. For the companies operating street cars or furnishing street railways with energy, the longer hours of daylight during the warmer and pleasanter weather open up a good opportunity for boosting the outdoor life, for boosting the parks and places of amusement and for traveling. There are many ways of increasing load in a big way, as by electric traction, as well as in the smaller way by fans and current-consuming devices, and so forth.

The additional hour of daylight brought into the lives of many by the simple process of turning the clock ahead an hour means more outdoor exercise, more fresh air, more recreation for millions of city dwellers. It means we shall get more out of life and shall be enabled to put more into it as the result. While this daylight saving affects different interests and individuals differently there is much good in it for all and all should make the most of it.

Co-operative Merchandising by Utility and Dealer

ONE of the most conspicuous phases of the central station-contractor-dealer situation at the present time is that the public utility is recognizing more and more the justice and the benefit of considering the interests of the contractor-dealer in the handling of electrical appliances and merchandising.

Whether the public utility should or should not sell appliances is still a mooted question, for and against which many things may be said. However, it is a fact, of which there is no denial, that the dealer and contractor, should not be ousted from the merchandising field by price cutting by the public utility. The public utility is chiefly concerned with the load that accompanies the use of electrical appliances; the contractor-dealer with the profit in their sale and the work that their use entails. To this extent the central station cannot afford, perhaps, to place entire reliance upon the initiative or lack of initiative of the dealers and contractors in its locality. On the other hand, by pushing its sales of current-consuming devices at a price where the absence of profit must be made up by energy sales, and by so doing monopolize the market and curtail the profits of those that exist by their merchandising profits the utility works great hardships upon and creates much enmity with the electrical dealers. But by working together, central station and electrical dealer can accomplish even more than effort by only one, or individual effort exerted by both. In other words, co-operation and harmonious action together will bring greater results and mutual gain.

Seasonal merchandising, concentration of effort upon some definite device, and co-operative campaigns by all concerned with the sale of current-consuming devices are now recognized as being more effective of results than haphazard effort by individual merchants who take no cognizance of what neighboring merchants are doing. And in bringing about this co-operative merchandising the manufacturers have done much and can do still more to bring about co-operation and unity of purpose between central stations and dealers, furnishing display and advertising matter. In unity there is strength, and in concentrating upon some specific device and all helping together throughout a definite territory higher sales will be made than where every merchant is independently trying to sell any and all appliances. In making these sales campaigns a success, it may be pointed out that the public utilities, with their newspaper advertising, their mailing lists, their bills and close contact with their customers, can do an enormous amount to help the business of the contractor-dealers in their territory, and in doing so help themselves.

Current-consuming devices are of little value as load builders if not used. Few perhaps realize the extent to which lack of outlets judiciously placed is responsible for curtailing the use of domestic current-

consuming devices. We have brought up this subject before on several occasions, because it is a very important one. The value of current-consuming appliances as load builders depends upon the extent to which they are used; although the connected load they represent may bring in revenue where a fixed charge according to connected load is in vogue. Every central station is thus vitally interested in pushing the sale of outlets so that all and any appliances in a home or elsewhere may be used when needed and simultaneously if need be. Every dealer and contractor is also interested, for these outlets increase the market for electrical appliances, they create work and add to the activity of the trade.

In too many homes lack of outlets is curtailing the energy consumption of current-consuming devices, is restricting the market for them, and preventing them from being as useful as they ought to be. Central station, dealer and contractor together should continuously push the campaign for increasing the number of outlets in the home already built or that is to be built. The appliance will come the easier where there is the outlet ready for it.

The Feeder Regulator as an Asset

WHERE many feeders or circuits emanate from a power plant or substation it is impractical to regulate the station bus pressure to maintain constant voltage at the end of all the feeders unless all feeders have the same length and identical characteristics and loads of the same magniture and characteristics simultaneously. In practice various feeders have different lengths and their loads vary in magnitude and in time. The commonsense solution is, therefore, to install feeder voltage regulators in the individual feeders and regulate each feeder according to its length and its load, maintaining the station bus pressure at such value as to permit the regulators to remain within their working range.

Up to the present time many small companies have foregone the use of feeder regulators—and voltage regulation has suffered accordingly—because it was felt their cost was not justified in view of the quality of service demanded and the magnitude of the system. Today, however, the standard of service is becoming more exacting, and operating economies are combining to encourage the use to a larger extent of the feeder regulator. While the feeder regulator accomplishes several functions which might be accomplished in other ways, it is sometimes the only sane solution, and the most economical one.

Feeder voltage regulators are too often considered only as a means of improving service. This of course they do, but their cost should not be charged against improved service alone. Rather should it be balanced against cost of conductors, cost of stringing or reinforcing wires, and the loss due to voltage drop upon revenue and lamp life, and renewals where free.

In meeting increased loads upon circuits already fully loaded, the feeder regulator offers at once a simple and effective solution in many instances. The regulator can be installed with a minimum of labor. It can care for an existing situation and allow reinforcing of copper to take place when convenient or as indicated.

Regulators enable improved service, they increase the efficiency of the system, permit greater return upon the investment, and give a flexibility of operation not otherwise obtainable. In the days to come, the days of readjustment, reconstruction, reorganization, the induction feeder regulator should be found a very useful adjunct to many a system where heretofore its use was not considered justifiable.

Rate of Remuneration of Government Engineers

THE Bureau of Mines is announcing an examination for a "junior electrical engineer" who must have "graduated from a four years' course in electrical engineering in a college of recognized standing, and have at least one year's experience in electrical engineering work outside college." The applicants are not only required to have "investigative ability, energy, enthusiasm and ingenuity," but also should be "skilled in making drawings and sketches, in the use of tools, working wood and metal and must be familiar with machine design and the properties of metals. Applicants must not have reached their thirtieth birthday at the time of examination."

"Every laborer is worthy of his hire." A man fulfilling the above requirements, according to the Bureau of Mines, is worth $1080 to $1200. At least that is the salary offered for raw material with the above qualifications.

We are not immediately concerned whether a man below thirty can have graduated from a four-year engineering course and have also obtained one year's engineering experience and also become "skilled" in making drawings and sketches, and familiar with machine design, the properties of metals, and the use of wood and metal-working tools. But we do wonder if it is fair to offer a man who at the age of thirty has accomplished these things, the sum of between $90 and $100 per month. How much can be spent on education and experience if the return at thirty years is $100 per month?

One of the most pleasing records of Government departments is that of the Bureau of Mines. In many and varied fields of effort it has made an enviable and magnificent record. It has possessed many able and capable men. But we recall that many of those who made the name of the Bureau of Mines famous, in doing so, themselves rose in their professions, and in rising increased their rates of remuneration. But to do this latter, many of these men are no longer with the Bureau. And their having left is a loss to the country as a whole, although it may be their personal gain.

Week's Events

Wisconsin Contractors, Minnesota and Wisconsin Central-Station Men Meet—Furnace and Welding Men Organize

WISCONSIN CONTRACTOR-DEALERS HOLD INTERESTING MEETING.

Annual Convention Indicates Big Improvement Made by Association During Past Year.

The Wisconsin State Association of Electrical Contractors and Dealers held its annual convention March 24, 25 and 26 at the Hotel Pfister, Milwaukee, Wis. The association in that state has made wonderful progress during the past year in its organization and educational efforts, and the convention was very good evidence of this progress. Due to the absence of the regular chairman, the convention was presided over by C. A. Burrill, of the Herman Andrae Co., of Milwaukee, and F. H. Patrick, of Racine, acted as treasurer during the meeting in place of the late Mr. Johnson.

The progress made by this association during the past year was indicated in a very substantial way by the manner in which the members present interested themselves in the proceedings, and took part in discussions of the numerous papers presented. Not a single paper or address was presented which was not followed by an enthusiastic and instructive discussion.

A considerable number of manufacturers made exhibits of their products at the hotel during the convention. These included not only the heavier contractors' supplies, but also a wide assortment of appliances, such as washers, lamps, fixtures, farm-lighting plants, motors, safety switches, etc.

At the opening of the afternoon session on Monday, W. H. Morton, general manager of the National Association of Electrical Contractors and Dealers, delivered a very interesting address in which he described the work of the association and the many advantages offered to its members. During the past year the activities of the association, although greatly hampered by war conditions, have been considerably broadened and improved. The reorganization of the association under the new plan, for example, has eliminated any possibility of section domination and has placed the district affairs in the hands of the district members. The contention that under the new plan the dues have been materially increased is greatly exaggerated, Mr. Morton stated, for the reports show that the average annual dues paid the association are $10.30—a raise of only 30 cents over the old fees.

While the value of the national association to the members cannot be expressed in actual dollars and cents, except in a few instances, there are numerous advantages to be obtained by membership, the direct value of which is limited only by the extent with which they are applied. These advantages Mr. Morton demonstrated by reviewing briefly the work of the various committees of the association.

The Code Committee has developed a much easier method by which the contractor can appeal from an inspector's decision. The Engineering and Architects' Committee is now developing a plan with the national committees of the representative associations of these professions by which it is expected to eventually eliminate the general contractor from the field. The Legislation Committee is working on a universal state licensing law. In addition, the work of the Labor, Standardization, Cost and Accounting, Chamber of Commerce and other committees has developed many features of value to the electrical contractor-dealer.

New Standard Accounting System.

Following Mr. Morton's address, J. E. Sweeney, of Waterloo, Iowa, chairman of the Committee on Accounting, explained the new approved credit and accounting system, recently adopted by the National Association. This system is the outgrowth of the increasing demand for proper and adequate accounting, not only in the electrical but in all successful businesses, and is radically different in all respects from the old system. The new method is the result of the co-operative effort of this committee and the similar committees of other branches of the industry and bears the endorsement of the National Credit Association, the Society for Electrical Development, the Electrical Supply Jobbers' Association and the Associated Manufacturers of Electrical Supplies. The basis of the system is incorporated in six cardinal principles as follows:

1. All forms should be standardized. The advantage of this is that, aside from the saving effected in price and delivery by having these forms supplied from a central source, the contractor-dealer will have on hand all the essential facts of his business through a uniform procedure and be able to make comparison statistically with others in the same line of business.

2. All sales, whether contract, jobbing, day work or retail, should be costed. By this the contractor-dealer at any time will know the exact state of his finances and whether or not any certain job, appliance or department of his business is making or losing money for him.

3. A merchandise account should be created through debit entries for purchases and credit entries at cost for material sold in any way. Through this account, the contractor-dealer is enabled to tell at any time the value of the stock on hand, the rate of turnover, the proper amount of insurance to carry, etc.

4. A general ledger containing all controlling accounts should be made part of the system. Most contractors already keep a book of this sort where they assemble in a condensed form information regarding assets and liabilities.

5. All liabilities should be vouchered each month irrespective of receipt of goods or correctness of invoice, provision being made for charging vendors for any discrepancy in invoices. This is a practical arrangement to insure getting every liability properly entered and accounted for, thus preventing disputes with people from whom purchases are made.

6. The cash book should combine the records, both receipts and disbursements—that is, debit entries

equalizing bank deposits for the month and credit entries equalizing charges to bank balance. This will serve to keep the contractor-dealer in touch with his bank account and tend to systematize and prevent leaks in the business. The cash book should not be used for distribution.

To carry out these principles suitable forms have been worked up which are designed to cover every transaction in detail in the routine work of operating the system so that accuracy may be obtained. The complete system as furnished will consist of one loose-leaf binder with five index sheets, this to contain cash received, cash paid, journal, voucher register, and sales recapitulation sheets. Also one loose-leaf binder with two indexes to hold the accounts receivable and payable, one bound general ledger and one bound trial balance book covering five years' operation will be included.

The standard forms are as follows: Requisition for material, time card, return material sheet, job envelope, material summary sheet, sales recapitulation sheet, accounts receivable sheet, accounts payable sheet, cash received, cash paid, voucher disbursements, and journal sheets. In addition, a practical designation of accounts has been standardized.

These forms made up in lots containing a sufficient number for the average business will be supplied to members of the association for $25 each, f. o. b. shipping point. Non-members may also purchase sets for $40 each. Arrangements have been made whereby these sets will be distributed from several places throughout the country.

Mr. Sweeney showed that the advantage of the use of such a system as has been described are many. The contractor-dealer will know positively from day to day the standing and progress of his business. It will bring to his attention immediately the unprofitable job and give him an opportunity to investigate the reason and avoid a similar occurrence. He will be able to give an accurate statement of his business condition that can be presented to a banker or jobber which will instill confidence in him and his business.

Before closing his address, Mr. Sweeney dwelt briefly on the subject of credit and its relation to the new system. Quoting J. H. Tregoe, secretary of the National Association of Credit Men, he said that the underlying fundamentals of credit are the three big "C's"—character, capacity and capital. The contractor-dealer's character is usually beyond reproach. His capacity or ability will be judged by whether or not he understands the technical end of his business and is conducting it along up-to-date lines. If so, he will be able to secure the third requisite, the necessary capital to expand and grow into a prominent place in the business world.

In the discussion which followed Mr. Sweeney's presentation of this plan many important features of it were brought out and explained very clearly to those present. Among those who took an active part in this discussion were Mr. Wilkins, of the Belden Manufacturing Co., Chicago; A. L. Oppenheimer, of Cleveland, Ohio, and B. L. Burdick, of Milwaukee.

A. L. Oppenheimer, of the Enterprise Electric Co., Cleveland, then gave a very interesting talk on the important features of successful electrical merchandising. He is a very successful merchant and his remarks carried additional force on this account. He explained the value of tying or linking the dealer's name with the manufacturer in appliance sales and advertising, and explained the follow-up system used in his store to increase sales. In this system an attempt is made, whenever an article is sold, to ascertain what other electrical appliances the customer has and this is entered in a record. At certain intervals thereafter an effort is made to interest the customer in the other appliances which he or she may need.

The meeting opened Tuesday morning with an address by Steward Scrimshaw, of the Industrial Commission of Wisconsin, on the new apprenticeship law which is being worked out in that state. He described the advantages of the law from all viewpoints and appealed to the electrical contractors and dealers for their close co-operation in working out the details of that part of the law which related to electrical apprentices.

Mr. Scrimshaw was followed by Samuel A. Chase, of the Westinghouse Electric & Manufacturing Co., who explained very clearly the contractor-dealer's opportunity. Mr. Chase placed the blame for the past, and in many cases present, difficulties of the industry on the lack of understanding that has existed between the different branches regarding each other's problems. A better knowledge of these problems would serve to eliminate these difficulties, Mr. Chase pointed out, as was shown by the progress that has been made in several localities where these various interests have gotten together and discussed each other's problems in open meetings. He advocated the adoption of the slogan, "Live and Help Live," and its practice by the members.

Mr. Chase strongly urged the members to open retail stores. In the past, due to the lack of stability of prices, this has been difficult, but this situation is now rapidly being improved. There is room for all in the merchandising field, however, and it is up to the contractors to open attractive retail stores if they are to take their right place in the industry. In this work they will find that the National Association and the manufacturers and jobbers are eager to assist them.

He also advocated the bettering of wiring conditions by the installation of more outlets and stated that probably not one house in a thousand is adequately wired to allow the convenient use of the various electrical appliances. By increasing the number of outlets, however, this will assure their use for the purpose for which they are intended and not as ornaments only. Mr. Chase also suggested several methods by which the contractors and dealers could improve their conditions and, in closing, stated that he himself was willing and anxious to co-operate with them in every way possible.

Thomas Casey, vice-president of the Hurley Machine Co., Chicago, then gave an instructive talk on better merchandising. He explained the need of selling service as well as merchandise and showed the advantages which accrue from the performance of proper service. He described several cases which had been brought to his attention where after one contractor-dealer had failed to show results another had been very successful. He also explained the many advantages of the easy-payment plan of selling and the value of advertising such plans. In addition, he exposed the fallacy of a dealer trying to carry too many lines of any certain appliance, thereby confusing the customer as to which he should take and often losing a sale as a result.

J. A. Morrisey, of the Wisconsin Inspection Bureau, then described the relation of the fire-insurance inspector to the electrical contractor and explained the recent changes in the National Electrical Code which directly affect the electrical contractor. Mr. Morrisey's talk was given the closest attention

and was followed by numerous questions and considerable discussion.

The banquet on Tuesday evening was very well attended by the members and their lady guests. Addresses were made by several visiting contractor-dealers and other prominent persons, all of whom spoke very optimistically of the future of the industry. Among the speakers on this occasion were: A. L. Oppenheimer, Cleveland, Ohio; J. D. Sweeney, Waterloo, Iowa; E. F. Pendergast, Rockford, Ill.; Henry Newgard, Chicago, and Mr. Tompkins, of the Milwaukee office of the Western Electric Co. Robert T. Lozier, past president of the Edison Pioneers' Club, and prominent in the industry for many years, also delivered a short address describing the financial requirements of the country and their effect upon the central station and other electrical industries. William H. Morton, general manager of the National Association of Electrical Contractors and Dealers, explained the importance of the association's coming national convention, which is to be held in Milwaukee July 15 to 17.

ADDRESS BY MR. GOODWIN.

William L. Goodwin then delivered a very enthusiastic address in which he brought out very clearly the need for closer co-operation and co-ordination of effort between the contractor-dealers themselves and the other branches of the industry. Taking advantage of the fact that there were many ladies present, Mr. Goodwin appealed to them to use every effort possible to influence their contractor-dealer relatives to establish better conditions among the fraternity. According to Mr. Goodwin, the ladies should believe that 25-20, without necessarily comprehending the exact definition or meaning of the figures, meant one new dress a month, and that 30-20 meant two new dresses a month. Mr. Goodwin explained the valuable assistance which had been rendered to the contractors of California after the appeal which he had made on one occasion to the ladies of that state. It was his firm conviction that through their efforts the ladies could accomplish a great deal towards the improvement of the electrical situation which existed.

He explained very carefully the absolute fallacy of price cutting—"the greatest indoor sport known," as he termed it. At present many contractor-dealers in different locations of the country are asking the manufacturers to provide them with wider discount margins in order to assure them of sufficient profits. However, in the past, it has been found that when the manufacturers have conceded this point to any extent, the contractor-dealer has thrown the extra profit provided away by immediately cutting prices.

He brought out very clearly the need for facts with which to substantiate the claims made to the manufacturers by contractor-dealers, and stated that it was largely due to the absence of these facts that the present condition existed. The national organization in its efforts along these lines should receive the earnest support of the individual members, for it was only through these methods that any influence could be brought to bear upon the manufacturers, jobbers or central stations.

Mr. Goodwin urged the members to support the better grade of electrical materials, and illustrated the value of the influence which the Electrical Committee of the National Fire Protection Association has had upon the development of the use of electricity in this country. In conclusion, he urged the members not to despond if their first efforts towards co-operation with the other branches of the industry failed, and not to allow the deficiency of these other branches to reflect in any way upon their activities.

At the Wednesday morning session, John R. Smith and E. L. Morley, representing the Chicago Electrical Estimators' Association, presented the results which had been obtained by this association during the past year. These included its labor cost data, its table of overhead percentages and the estimating forms. These have been described from time to time in the ELECTRICAL REVIEW, and are gaining rapid favor among the electrical contractor-dealers throughout the country. Messrs. Smith and Morley explained these very clearly and pointed out that estimating forms the most essential part of the contracting business.

In the discussion which followed the value of these data was fully brought out. Mr. Goodwin gave the Chicago Electrical Estimators' Association considerable credit for the way its members have developed these data and their method of presenting them. He explained that through the accumulation of reliable data of this sort not only would the electrical contractor-dealer receive considerable education, but the industry as a whole will be greatly benefited. He urged the co-operation of the contractors with the Estimators' Association and the formation where feasible of similar organizations. He brought out the fact that at the present time it was too easy for anyone to enter the contracting business, and this is largely responsible for the state of affairs at present. When the estimators have finished their work and when the majority of contractors have been educated to the proper standards and to the proper conduct of their work, Mr. Goodwin believes it will be an easy matter to eliminate the unreliable contractor from the field.

The meeting closed after the election of officers for the coming year. This resulted in the following men being chosen: C. A. Burrill, Milwaukee, chairman; John L. Acker, Sheboygan, treasurer; John C. Piepkorn, Milwaukee, was re-elected secretary. The following Executive Committee was chosen to represent the various districts: J. J. Kelley, Eau Claire; George Spiegel, Clintonville; B. L. Burdick, Milwaukee; Mr. Larsen, Racine, and Mr. Duerr, Stoughton.

INTERESTING FEATURES OF WIRELESS TELEPHONE.

Details of Equipment Used for Communication with President Wilson.

Considerable interest attaches to the fact that President Wilson had been able to talk with the Navy Department at New Brunswick, N. J., while on the transport *George Washington* and 3200 miles from land. The wireless telephone apparatus employed was invented and designed by Dr. Ernest F. W. Alexanderson, consulting engineer, General Electric Co. Although wireless telephone messages have so far been sent 3200 miles, it is not thought this represents the maximum distance wireless messages can be transmitted. At present the only receiving apparatus is installed upon the *George Washington*.

The sending station at New Brunswick is equipped with thirteen 400-ft. antennae. The station may be used for either wireless telegraphy or telephony. The Alexanderson apparatus consists of the high-frequency generator, the magnetic amplifier and the multiple tuned antennae. The rotor of the high-frequency generator weighs almost 3 tons, rotates at

2100 r.p.m. and has a speed regulation within 0.01% from no load to full load. The machine has a rating of 200 kw., has total weight of about 12 tons and occupies a floor space of 8 ft. in width by 20 ft. in length, being less than 2% of the total station floor space.

JANUARY ELECTRICAL EXPORTS BREAK ALL RECORDS.

Over 44% Increase on a Year Ago and Nearly 9% Increase Over Previous Monthly Record.

An exceptionally heavy call for American electrical products came from abroad during last January when the electric exports of the United States exceeded $6,720,000, established a new monthly record. January of 1918 was surpassed by over 44% and the record total value of last November was excelled by 8.8%. The classified and comparative figures are given in the following table:

Articles.	January 1919.	January 1918.
Batteries	$ 345,811	$ 295,520
Carbons	189,351	93,543
Dynamos or generators	249,853	252,429
Fans	176,526	68,541
Heating and cooking apparatus	98,515	59,652
Insulated wire and cables	804,481	548,931
Interior wiring supplies, including fixtures	194,565	104,710
Lamps—		
Arc	206	671
Carbon filament	20,041	9,567
Metal filament	578,175	200,420
Magnetos, spark plugs, etc.	279,174	380,098
Meters and measuring instruments	324,404	124,192
Motors	680,882	555,842
Rheostats and controllers	48,436	13,007
Switches and accessories	177,159	271,196
Telegraph apparatus, including wireless.	56,541	9,208
Telephones	214,172	249,992
Transformers	309,028	174,001
All other	1,975,204	1,245,091
Total	$6,722,524	$4,656,611

Not included in the above table, there were shipped last January 7 electric locomotives valued at $24,501.

A fair idea of the principal foreign purchasers of American electrical equipment may be gained from the following data extracted from the report of the Special Statistical Service Section, Bureau of Foreign and Domestic Commerce, Washington, D. C., the figures covering shipments during January, 1919; the countries are given in order according to the value of their purchases.

Batteries—Canada, $68,197; Australia, $66,947; Norway, $43,304; Argentina, $39,498; British South Africa, $20,291.

Carbons—Canada, $90,251; Japan, $41,412; Australia, $15,940; Chile, $7130.

Dynamos and generators—Norway, $60,959; Japan, $43,593; Canada, $30,118; Cuba, $22,441; Mexico, $14,935; China, $13,114.

Fans—British India, $73,385; Hongkong, $31,093; Philippine Islands, $17,493; China, $14,007.

Heating and cooking apparatus—Norway, $19,470; Australia, $14,965; Argentina, $10,909; Canada, $9953.

Insulated wire and cables—Brazil, $109,722; British South Africa, $101,234; Argentina, $71,997; Cuba, $69,053; Australia, $56,318.

Interior wiring supplies—Brazil, $30,130; Cuba, $28,214; Philippine Islands, $23,117; Canada, $18,169; Argentina, $14,197.

Metal-filament lamps—Brazil, $134,551; Argentina, $62,570; Mexico, $56,865; British South Africa, $51,206; Australia, $42,884.

Magnetos, spark plugs, etc.—Australia, $66,842; Canada, $45,923; Italy, $28,350; Argentina, $26,312; England, $23,532.

Meters and measuring instruments—Australia, $105,924; Japan, $48,153; Argentina, $43,001; Brazil, $21,686; Canada, $18,367.

Motors—Canada, $101,791; Japan, $66,734; Australia, $57,278; Philippine Islands, $55,065; Argentina, $44,690; Brazil, $43,764.

Rheostats and controllers—Japan, $22,068; Canada, $12,518; Australia, $5557.

Switches and accessories—Norway, $35,803; Australia, $25,566; Canada, $25,220; Brazil, $20,083; England, $13,936.

Telegraph apparatus—England, $21,133; Canada, $10,436.

Telephones—Brazil, $70,850; Norway, $33,546; Japan, $31,017; Australia, $14,815.

Transformers—Japan, $69,865; New Zealand, $45,957; Brazil, $40,164; Spain, $36,400; Cuba, $20,153; Italy, $18,422.

All other articles—Canada, $379,176; Japan, $165,384; England, $149,329; Brazil, $145,041; Australia, $139,465; British India, $115,229.

MINNESOTA ELECTRICAL ASSOCIATION HOLDS ANNUAL CONVENTION IN ST. PAUL.

Discussion of Important Problems, Address by Secretary of Commerce Redfield and Large Exhibit Features of Successful Meeting.

The twelfth annual convention of the Minnesota Electrical Association was held at the St. Paul Hotel, St. Paul, Minn., during March 18, 19 and 20. The meeting was one of the largest during the life of the organization. B. W. Cowperthwaite, retiring president, was in the chair.

In opening the convention, Mr. Cowperthwaite spoke of the labor problem before the war and during the reconstruction period through which we are now passing. The electrical industry was vitally concerned in the labor problem. He then went on to speak of the electrical industry, and the central station and merchandising especially, reviewing some of the difficulties under which they have labored during the restriction of wartime. The signs of the times, labor and social unrest, the cry for government ownership in some quarters were other matters touched upon. The financing of public utilities, their importance and power for good in the community, were touched upon by Mr. Cowperthwaite, who then enlarged upon this question of public utility financing from the aspect of selling public utility stock to local interests, a method that not only was a convenient and cheap way of obtaining capital but one also that tended to prevent discontent and make the local utilities the playthings of politicians.

In response to a letter from the United States Department of Labor asking for co-operation from the association in the work of the United States employment service in procuring work for skilled electricians discharged from the army and navy, it was decided to forward to the department a list of the membership of the association so that the members might be circularized by the Employment Service.

"The Electrical Industry in the Reconstruction Period" was a paper read by F. L. Cross, vice-president and general manager, St. Paul Gas Light Co. Mr. Cross embraced in his paper a review of conditions as they are and as they were before the war, of the problems of the hour as faced by the public utilities and all employers of labor. There are today diffi-

cult problems of policy toward stockholders, toward the public; the question of public relations is one that is receiving the closest attention by all those that feel the trend of the times. The financing of utilities, the sale of stock to the local public and customers is a matter deserving careful consideration.

D. F. Parrott, Minneapolis General Electric Co., read a paper entitled, "Recent Developments in Transmission Line Construction for Medium Voltages." This paper was accompanied by lantern slides. Mr. Parrott discussed various forms of line construction for various potentials, giving cost data upon the basis of man-hours for various forms of construction. This was a very instructive paper and will be reproduced in a future issue of the ELECTRICAL REVIEW.

In the afternoon the association made an inspection trip over the by-product coking plant of the Koppers Coke Co., St. Paul. This trip was taken by about 200 members of the association and their guests. The Koppers Coke Co.'s plant is entirely electrically operated throughout, service being furnished by the St. Paul Gas Light Co.

On Thursday, W. F. Heald, Duluth Edison Co., presented a paper entitled, "Merchandising Methods for Central Stations." This paper took up the various phases of merchandising by the public utility, co-operation with the contractors and dealers, methods of reaching the prospect, the prosecution of seasonal campaigns in co-operation with the local contractors and dealers. Discussion of this paper emphasized the value of central-station advertising in local newspapers, on bills, etc., and the way in which such advertising campaigns may be made to help the local electrical dealers. It was further brought out that the public utility should work in conjunction with the local dealers on seasonal appliances, concentrating at any one time on some certain appliance. In this way the public is approached from all sides, making a strong impression that brings results.

"Wastes and Opportunities for Economies in Central Stations" was the second paper of the day. This paper was delivered by H. J. Meyer, formerly administrative engineer for Minnesota, United States Fuel Administration. Mr. Meyer spoke of his experiences during his connection with the Fuel Administration, of conditions as he found them in many of Minnesota's power plants. He gave data showing what conditions were brought out by the questionnaires, and told of some of the absurd occurrences he encountered. In closing, he made a plea that coal saving continue to be carried on. He said that the Minnesota Electrical Association might with advantage to itself and the state appoint a committee whose duty it would be to compile data as to the coal consumption of public utility power plants in the state. These data could be published without the actual identity of individual plants being given. The result would be that the plants showing the highest coal consumption could be improved and coal saved. This paper brought out some discussion as to the proper basis of recording coal consumption, whether as coal per kilowatt-hour, pounds of steam per pound of coal, etc. The question of whether performance should be based upon pounds of coal or upon thermal units or therms was another subject that received its quota of discussion. The payment of bonuses to firemen brought out some spirited discussion as to whether payment of a bonus according to CO_2 or to evaporation was fair and equitable. One speaker pointed out that a bonus paid upon gas analysis, CO_2 was only feasible where the fireman only took care of the firing, but was not responsible for evaporation or the condition of the boiler. However, the difficulty with this arrangement was that a sliding scale was necessary, since the percentage of carbon dioxide giving the highest commercial efficiency depended upon the coal used. Such a bonus required that the coal be analyzed and the limits of carbon dioxide content be determined. In this same connection it was pointed out that it is preferable to pay a bonus to the shift, dividing the bonus in some way among the men. In this way all are interested in the performance of their fellow workers, a condition which soon eliminates the shirker or incapable men, since their behavior affects the other men's bonus.

After luncheon, and on the opening of the afternoon session on Thursday, Secretary of Commerce Redfield addressed the meeting in a brief talk regarding conditions as they are today, what the reconstruction period implies, how employe and employer must adjust themselves, and the forthcoming fifth Liberty or Victory Loan. He then went on to speak of what the country has accomplished during the strenuous times that the war was being prosecuted. He laid emphasis upon the importance to the country and the individual of absorbing the stored energy gained, and allowing the momentum to help in taking up the work of peace. He then went on to tell of some of the difficulties the country faced with the opening of hostilities, of the magnificent achievements made in things electrical and the glorious part played by electricity and electrical men in bringing victory. Secretary Redfield enlarged upon some phases of electrical matters, one of the most interesting of which was the manner in which the Navy took over the German installed, operated and owned wireless station at a time when this country was entering the war.

The fourth address of the day was by Prof. G. D. Shepardson, department of electrical engineering, University of Minnesota. Professor Shepardson spoke of the way in which theory and practice advance together, the one leading the other and sometimes following. While many theories and many new things are continually appearing, both theory and practice are based on fixed laws that do not change, but only assume new aspects. He then told of some recent achievements, particularly as related to the waging of war, how new problems had presented themselves, and how they had been solved. In closing, Professor Shepardson emphasized that things are moving very fast nowadays and that those who cannot keep up fall behind. He emphasized the need for wideawake engineers to keep abreast of the times and to endeavor to know what is going on, of new methods and new demands. For many men, the technical press offers the best, sometimes the only, way in which one can keep in touch with the march of events. Men should subscribe personally to the technical papers in their field. It is not enough to glance through the copy subscribed for by their employer or company or the library copy. Only when you own your own copy and have it when you want it can its true value be obtained.

At the close of the meeting, election of officers for the ensuing year was held. F. L. Cross was elected president; L. Peterson, vice-president; R. M. Howard, second vice-president; J. Barnard, secretary-treasurer. The executive committee appointed was composed of the above with the addition of W. F. Heald, Duluth Edison Co. Included in the resolutions passed by the association was one that the association do all in its power to promote industry upon a pre-war basis. Another resolution unanimously adopted was to the

effect that the association should encourage a better and more friendly feeling between employer and employe, bring about closer co-operation and closer understanding.

The convention was brought to a close by a banquet in the evening, given by the Twin Cities jobbers. This banquet was well attended and everyone attending the convention went away with a feeling that the transition from war to peace is beginning to make headway, that construction work and improvements, line extensions, and better business is at last beginning to be felt in the electrical industry of Minnesota. The dealers' and jobbers' exhibits were the largest ever held for the association and reports of exhibitors indicate a big buying power for heavy apparatus and appliances.

STANDING COMMITTEES OF THE ELECTRICAL COMMITTEE, N. F. P. A.

Personnel of Committees That Are Ready to Investigate and Study Proposed Changes in National Electrical Code.

In accordance with the newly adopted procedure of the Electrical Committee of the National Fire Protection Association, which was noted in our issue of March 15, the following standing committees have been appointed to have a general direction and supervision of investigations and recommendations for future changes and revisions of the National Electrical Code.

Cars and Railways—M. Schreiber, chairman, American Electric Railway Association, Newark, N. J.; R. C. Bird; Ralph Sweetland.

Devices and Materials—A. R. Small, chairman, Underwriters' Laboratories, 207 East Ohio street, Chicago, Ill.; H. R. Sargent; H. O. Lacount.

Fixtures, Heaters, Signs and Lamps—J. C. Forsyth, chairman, New York Board of Fire Underwriters, 123 William street, New York City; G. E. Breun; C. H. Lum.

Generating and Substations—A. M. Schoen, chairman, Southwestern Underwriters' Association, Atlanta, Ga.; W. H. Blood; K. W. Adkins.

Grounding—W. H. Blood, chairman, National Electric Light Association, 147 Milk street, Boston, Mass.; C. M. Goddard; H. S. Wynkoop.

Industrial Applications—G. S. Lawler, chairman, Associated Factory Mutual Fire Insurance Companies, 31 Milk street, Boston, Mass.; F. Osgood; C. B. Langdon; J. M. Curtin.

Outside Wiring, Building Supply and Services—M. G. Lloyd, chairman, Bureau of Standards, Washington, D. C.; C. H. Hill; F. F. Burroughs.

Signal Systems, Wireless and Lightning—W. S. Boyd, chairman, Western Association of Electrical Inspectors, Insurance Exchange, Chicago, Ill.; A. M. Paddon; C. W. Mitchell.

Theaters, Moving Pictures, Places of Public Assembly and Garages—Washington Devereux, chairman, Philadelphia Fire Underwriters' Association, 141 South 4th street, Philadelphia, Pa.; V. H. Tousley; C. M. Tait.

Wiring Standards and Systems—W. C. Peet, chairman, Peet & Powers, 70 East 45th street, New York City; Dana Pierce; F. Overbagh; R. P. Strong.

Suggestions for proposed changes in the National Electrical Code should be sent to Dana Pierce, chairman of the Electrical Committee, 25 City Hall Place, New York City, for reference to one or more of these standing committees. It is the desire of the committee that all such suggestions be made as soon as possible in order that there may be ample time for careful investigation and consideration of their merits.

TEACHING THE PUBLIC A CONCEPTION OF ILLUMINATION INTENSITY.

S. E. Doane in Speaking Before Chicago Illuminating Engineers Emphasizes Importance of Concrete Concept of Illumination.

One of the great opportunities before the lighting industry today is to develop on the part of the general public a definite conception of illumination intensity, making the meaning of the foot-candle equally as clear as the foot or other unit of length. This is the opinion of S. E. Doane, chief engineer of the National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio, as expressed in a talk before the Chicago Section of the Illuminating Engineering Society on March 20. To speak of greater illumination is as vague as to mention more time until the units and quantities are stated and comprehended. Illusive as time is, it is easily measured and even estimated by the ordinary citizen; illumination and its foot-candle unit should be made as meaningful. If this is done, progress in lighting betterment will be greatly accelerated.

Until recently it was difficult to get a reasonably correct conception of the foot-candle, but now there is available a convenient and inexpensive little instrument for quickly measuring intensities. Mr. Doane explained its construction and operation by means of a large model of foot-candle meter. He showed that it is possible to place it in the hands of a shop superintendent or store manager, for instance, to enable him to check up on the adequacy and uniformity of the lighting of his premises. In rubber mills its use has led to very material increase in illumination intensity. In dry-goods stores its use has shown to the management that dark goods require much greater intensity than white goods if customers are to be properly aided in examining and selecting the materials they wish to buy. Mr. Doane felt that the use of the foot-candle meter should not be confined to lighting salesmen and the management of large shops, stores, offices, etc., but that the maintenance electrician and journeyman electrician or wireman would find it profitable to insure a satisfactory lighting installation.

Ability to measure illumination intensity does not suffice, however. It is necessary to know what intensities are suitable for different working conditions and visual requirements. The most complete guide to these intensities is contained in the appendix to the proposed Lighting Code of the Industrial Commission of Ohio recently drafted, the values there given having been selected after careful investigation. In some cases it is necessary to provide for a variable intensity to accommodate changes in requirements, as when working alternately on light and dark textile fabrics.

Mr. Doane also emphasized that quality of the light, direction and distribution were equally as important as intensity. Avoidance of glare must not be neglected. In some cases the illuminating engineer must interest himself not only in the nature and position of the light sources and in the color of the ceilings and walls, but also in the color of many machine parts. It has been found especially desirable to select such a color for handles, levers, handwheels, etc., as to make these stand out conspicuously from their background

and thus make them readily grasped without visual effort or chance of accident.

The discussion following Mr. Doane's talk was in the nature of a round-table interchange of opinions, among those taking part being J. N. Pierce, W. A. Durgin, J. R. Cravath, A. A. Gray, E. D. Tillson, Mr. Anderson, F. H. Bernhard and Mr. Doane.

ELECTRIC FURNACE ASSOCIATION FORMED BY AMERICAN MANUFACTURERS.

Organization Perfected to Actively Promote the Use of Electric Furnaces and Electric Furnace Products.

Important steps were taken to promote the use of various electric furnace products, at a meeting called by Acheson Smith, vice-president and general manager of the Acheson Graphite Co., held at Niagara Falls, N. Y., on March 21 and 22. Mr. Smith called the meeting to order and made a general statement of the importance of getting before the consumers of electric furnace products, and the public generally, the many great advantages of the use of the electric furnaces, and the uniformly high-grade products which are made by them. He asserted that it was his belief that all interested in the matter could join together on a common basis to extend the use of electric furnaces and their quality products.

A special emphasis was laid on electric steel, the tonnage of which during the past four years has shown a remarkable increase, not only in the United States but throughout the world. This has been brought about for two important reasons, (1) the higher quality which can be made by use of the electric furnace, (2) and the lower cost of operation shown in most cases as compared with the previous method of manufacture.

The meeting passed resolutions inviting all manufacturers of electric furnaces, electrical apparatus, electric furnace supplies and accessories, public utility corporations, designers and inventors of electric furnace equipment, and the users of electric furnaces to become members and to join in making an aggressive and thorough campaign to disseminate to engineers and to the public accurate data as to the quality of electric furnace products of all kinds.

A splendid start was made in an organized way to carry out these plans. The meeting was attended by representatives of a large number of companies representing manufacturers of electric furnace equipment, accessories, utilities, supplies, designers and inventors, and manufacturers of electric steel. Among those present were the following: L. S. Thurston, C. A. Winder, G. Campbell, and J. A. Seede, of the General Electric Co.; C. J. Schluederberg, J. L. McK. Yardley, C. B. Gibson and R. P. Chase, Westinghouse Electric & Manufacturing Co.; F. J. Ryan, American Metallurgical Corp., Philadelphia; F. T. Snyder and F. Von Schlegell, Industrial Electric Furnace Co., Chicago; C. A. Vom Baur, T. W. Price Engineering Co., New York; C. H. Booth, Booth-Hall Co., Chicago; H. A. DeFries, Hamilton & Hansell, New York; R. J. Paulson, Ludlum Electric Furnace Co., New York; W. E. Moore, Pittsburgh Electric Furnace Co., Pittsburgh; F. A. FitzGerald of the FitzGerald Laboratories, Niagara Falls, F. J. Tone, Carborundum Co., Niagara Falls; Acheson Smith, E. G. Acheson, Jr., W. H. Arison, H. P. Martin, S. L. Walworth, A. M. Williamson, P. D. Steuber, J. F. Callahan, E. B. Drake, L. C. Judson and A. B. Oatman, of Niagara Falls.

The organization formed is to be called the Electric Furnace Association. A permanent organization was created as follows:

President—Acheson Smith, Acheson Graphite Co., Niagara Falls, N. Y.

First vice-president—C. H. Booth, Booth-Hall Co., Chicago.

Second vice-president—W. E. Moore, Pittsburgh Electric Furnace Co., Pittsburgh.

Secretary—C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., Pittsburgh.

Treasurer—F. J. Ryan, American Metallurgical Corp., Philadelphia.

Directors—The officers with C. A. Winder and F. J. Tone.

Important committees were created to begin work without further delay. These are as follows:

Publicity—C. H. Booth, chairman, C. A. Winder, C. G. Schluederberg and A. B. Oatman.

Data—W. E. Moore, chairman, J. A. Seede, A. M. Williamson, F. J. Ryan, F. A. FitzGerald and C. A. Vom Baur.

Fields—F. T. Snyder, chairman, F. J. Tone, H. A. DeFries and S. L. Walworth.

The president was authorized to get in touch with all companies and persons who should be interested in joining the organization, and was requested to arrange an early meeting when completed publicity plans could be presented and thoroughly discussed. In the meantime the different committees were instructed to make every effort to rapidly perfect reports which could serve as a basis for constructive work.

It is quite likely that the next meeting will be held in New York City, in the early part of April, at the same time as the spring meeting of the American Electrochemical Society.

CHICAGO ENGINEERS DISCUSS INDUSTRIAL DEMOCRACY.

Largely Attended Meeting Considers Spread of Bolshevism and How It May Be Met by Industrial Education and Mutual Responsibility in Management.

A subject apparently far removed from ordinary engineering topics was discussed at a joint meeting held on March 24 by the Western Society of Engineers and the Chicago sections of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, the meeting being held in the Western Society's rooms, Chicago. The topic for discussion was "Industrial Personnel Relations." In opening the meeting C. E. Lloyd, before introducing the speaker of the evening, said that most thoughtful people agreed that the interests of capital and labor are identical and each needs the other; the engineer, dealing with each, should be an unbiased judge of the relations of these two essential factors in industry and should throw what light he can upon the solution of the increasingly urgent problem of harmonizing these factors, for there is a growing menace in the steady spread of bolshevism.

The principal speaker was Arthur H. Young, manager of the industrial relations department of the International Harvester Co. In opening his remarks he cautioned against the opinion held by many engineers that the solution of this serious industrial problem was essentially one of engineering. Much has been done by safety engineering, efficiency engineering and modern industrial management, but the chief elements involved relate to human nature with

its extremely numerous variables. It was stated recently that some 24 points must be considered in the selection of men for any position in an organization. Most of these involve features that are far removed from engineering.

Mr. Young briefly reviewed the origin of the safety movement about 12 years ago and the great strides it has made in reducing accidents. It has resulted in benefit not only to the workmen, but also to the employers; the cost of putting into effect various safety measures has been less than the decrease in amount of damages and other losses formerly incurred from industrial accidents. This was practically the first movement to inject humanitarianism into modern industry. The rapid growth of large organizations reduced the opportunity for employer and employe to know each other and to appreciate their mutual problems. In later years it gradually dawned on progressive employers that the men should not be considered merely as machines. One outgrowth of this was the development of employment management. Whereas, in former times the employment manager prided himself upon selecting men at the rate of one a minute, or perhaps even less, now he takes the other extreme and tries to see how long it will take to place the proper man in a job fitted for him. Before the development of this employment service, snap judgment and utter failure to instruct in the nature of the work and its hazards was the usual practice. Nowadays each applicant is studied with deep interest to find out his training, experience and natural aptitude; he is given a talk on the policy of the company, detailed cautions regarding the hazards that will be involved in his work and careful instruction in every feature of that work. Many organizations even go as far as helping him to find a suitable boarding place if single, or residence if married; they show him how to get to the plant in the best way and impress him with the keen interest of the organization in his welfare, both while at work and while at home.

Respecting the spread of bolshevism in Europe and the attempt to develop something on that order in a few places in this country, Mr. Young said that it was due primarily to the failure of the industrial classes to know the economic and other important features of the industry and particular organization they were connected with, and he was convinced that to overcome it, it would be necessary to develop education along these lines. He referred to the Rockefeller plan put into effect by the Colorado Fuel & Iron Co., and the much more recent plan developed by the International Harvester Co. This is an attempt to realize what is called "industrial democracy."

In the Harvester plant within the last few weeks there have been set up works councils composed of 50% of the members selected by the workmen of the plant and the other 50% selected by the management. These councils are authorized to discuss and decide on all features connected with the conditions of employment; conditions in and about the plant, as well as hours of work and remuneration. All questions, whether they involve physical betterments or controversial matters must be decided by the unanimous vote of the works council, each half of which votes as a unit. In case of failure to agree, the question is left to decision either by the president of the company or by arbitration, or in some cases by a general council composed of representatives from all of the different works councils. So far 19 of the company's 20 plants have accepted this plan and although it has been in effect but a very short time, it is believed that it will mean the practical end of all controversies. It already has led to a very liberal offer by the men of one plant to voluntarily split, 50-50, the necessary reduction of hours of work and remuneration. Each works council is given all the inside information regarding the internal affairs of the company, so that through the representatives of the men on this council authentic and complete information regarding the company's business is always available. This feature alone, Mr. Young felt, would be the means of eliminating discord that arises frequently from underground rumors and misinformation so common in large organizations.

ELECTRIC RAILWAYS DISCUSSED AT NEW YORK MEETING.

Public Indifference Largely Responsible for Present Deplorable Conditions in Many Cities.

The average person thinks that because he owns no public utility securities he is not concerned with the financial conditions of these corporations. This is a serious mistake, according to Francis H. Sisson, vice-president of the Guaranty Trust Co. of New York in an address before the American Electric Railway Association in that city March 14, for the ramifications of the fiscal problems of the public utilities affect, directly or indirectly, every phase of the economic life of the communities they serve.

"In June, 1918," Mr. Sisson stated, "substantially all the banks of the country, except private banks, owned $385,000,000 of public utility bonds. Insurance companies, also, are large holders of such bonds. In New York State, alone, the public generally owns securities of electric railways to the amount of $1,282,500,000. And more than $6,000,000,000 is invested in the electric railways of the United States. These figures should be sufficient proof of the fact that direct interest in the welfare of public utility companies is not limited to those who are stockholders in these companies. Yet, the electric railways, representing an investment of $6,000,000,000, are rapidly going on the rocks—largely because of public ignorance of, and indifference to, the true conditions of this great industry."

The recent receivership for the Brooklyn Rapid Transit Company dramatically emphasizes the straits into which the electric railways throughout the country have been forced by various circumstances. Their plight is further evidenced by these facts: During 1918, 29 companies, with 2107 miles of tracks, went into the hands of receivers; there were foreclosure sales of 23 roads, with 524 miles of trackage; and 498 miles of tracks were abandoned, while fewer miles of new tracks than ever before were laid down. The mileage and capitalization of companies taken over by receivers in 1918 far exceeded those of 1915, the record year theretofore.

Up to the present, the electric railway companies have struggled alone with this desperate situation, but the problem is really a public one because the functions performed by these companies are essentially public. It is time for the public, which has reaped the benefits of the service rendered by the electric railways despite unbearable handicaps, to share in solving their problems. It is high time, indeed, that the public realize that when it attacks public utilities, such as the electric railways, or denies them fair treatment, it is attacking and injuring its own interests.

The general public's attitude toward the electric

railways has compelled these companies to operate under two distinct, and, in some respects, diametrically opposed kinds of law—legal and economic. The seriousness of this handicap is apparent when it is realized that probably one-half of the gross operating expenses of a railroad consists of direct labor costs, which are constantly increasing while the abnormally low rates for the service rendered by electric railways were, in many cases, fixed years ago by special laws, or by provisions contained in ordinances or franchises. But the franchise method of fixing rates is too rigid to meet present-day conditions. The franchise, while holding down the charges for the service does not hold down costs; consequently, costs have rapidly been overtaking gross revenues and have reduced to the danger point the margin between the two.

The commission form of regulation was developed largely with a view to remedying the evils of the rigid franchise method. The public utilities have long been laying their case before the state public service commissions, but relief has come very slowly. And now, of all times, the men composing the rate-making bodies of the various states must have the courage to adjust rates to existing circumstances and prevent ruin from overtaking many of these corporations. Their responsibility is a very grave one, both to the utility companies and to the public.

The present critical situation of the electric railway companies cannot wait for a solution of the future; it demands immediate betterment. And there is but one remedy—increase of income.

Transportation cannot be rendered at less than cost without the money to make up the deficit coming either from the security holders or the tax payers, or both. It should be obvious to all that the cost of transportation ought to be borne by the users of transportation, and that some plan should be worked out at once by which such provision is made. If municipal authorities maintain the position they have held, and unwarranted additions are continuously made to the tax burdens of our communities, the bonds of our municipalities will not be attractive to bankers or investors, and the growth and prosperity of various cities will be seriously threatened. Indeed, as has been pointed out, there is involved in the situation the validity of a huge structure on investment and credit, the undermining of which cannot fail to have far-reaching effects upon general credit and business prosperity, for the credit of our transportation lines cannot be placed in jeopardy and the effects localized or even restricted to these utility companies. Cities cannot be prosperous without efficient utilities; and utilities cannot be efficient without prosperity. Public regulation involves public protection of credit.

WISCONSIN ELECTRICAL ASSOCIATION HOLDS ANNUAL CONVENTION.

The Wisconsin Electrical Association held its annual convention at the Hotel Pfister, Milwaukee, March 26 and 27. The first part of this convention was held in conjunction with the Wisconsin Gas Association, at which the common utility problems were discussed.

This meeting was very well attended by the central-station and electric railway interests and the spirit of optimism and co-operation prevailed. Many interesting and original papers were presented which will be reviewed in connection with a more comprehensive report of the convention in our next issue.

DATES FOR NATIONAL CONTRACTORS' CONVENTION SET.

Annual Meeting of National Association of Electrical Contractors and Dealers to be Held in Milwaukee July 15 to 17.

At a recent meeting of the Convention Committee of the National Association of Electrical Contractors and Dealers it was definitely decided that the coming annual convention to be held in Milwaukee, Wis., this year would take place July 15, 16 and 17 at the Hotel Pfister. Prior to the opening of the convention, on July 13 and 14, the Executive Committee will meet in the same place.

POWER SALES BUREAU MAKES PLANS FOR CONVENTION ACTIVITIES.

The Power Sales Bureau will hold a dinner in Atlantic City during the week of the convention of the National Electric Light Association. The committee is actively engaged in developing the details and it is its belief that the dinner will surpass anything previously undertaken by the Bureau.

After two years' inactivity, the members of the Bureau will welcome the opportunity to again meet to exchange experiences and to renew the good-fellowship which predominates its activities.

Owing to many of the members having entered the country's service, the committee is experiencing difficulty in completing the mailing list. Members are therefore requested to acquaint the committee with their present address and business connections. John W. Meyer, of the Philadelphia Electric Co., 1000 Chestnut street, Philadelphia, Pa., is chairman of the committee.

OHIO METER COMMITTEE TO MEET AT DAYTON.

The Meter Committee of the Ohio Electric Light Association will hold its next open meeting in Dayton, Ohio, at the Engineers Club, corner Monument and Jefferson street on April 18, at 10 a. m. Two very instructive and interesting reports will be presented, one by A. M. Bryant, of the Cleveland Electrical Illuminating Co., entitled "The Scheduling of Service Tests of Small-Capacity Alternating-Current Meters"; and the other by J. L. Wright, of the Toledo Railway & Light Co., entitled "Training Men for Meter Work." Charles P. Garman, of Dayton, chairman of the committee, extends a general welcome to everyone interested in these two subjects.

AMERICAN WELDING SOCIETY FORMED.

At a meeting held in New York City on March 28, the American Welding Society was formed. This organization merges the Welding Committee of the Emergency Fleet Corporation and the National Welding Council. It will bring together in the manner usual for scientific societies persons who may be interested in any of the welding processes—forge welding, electric resistance welding (including spot welding), electric arc welding, gas welding, thermit welding, etc. It is intended to create and assist in maintaining a Bureau of Welding, which will be designed to take advantage of the principle of co-operation in research and standardization. Further particulars regarding the organization will be published in a later issue.

Commercial Practice

California Co-operative Campaign—Employes Auction Sale —House-Wiring Financing—Washer Delivery by Airplane

CALIFORNIA ELECTRICAL CO-OPERATIVE CAMPAIGN ACHIEVES GREAT SUCCESS.

Organization and Results of First Year's Activities—Plans for 1919.

The electrical industry on the Pacific Coast is, in the opinion of many, better organized and more progressive than in any other section of the country. This is especially true of California and the success achieved by the "California Electrical Co-operative Campaign" demonstrates this very clearly. This campaign was developed during the latter part of 1917 by the various branches of the electrical industry and in spite of the extreme conditions which prevailed during the past year has done a great deal towards improving conditions in that state.

The object of this campaign is better electrical service to the public, and, as the certain result of that service, more profit to individuals and companies in the electrical industry. The nature of the campaign is educational. It is not a sales campaign. It is not intended to directly help the dealer-contractor sell more appliances or more electrical service, but it is intended to show him how he can make his business better and more prosperous. It is also intended to help in a co-operative way the educational work that has been and is being carried on by organizations representing the different branches of the electrical industry.

The Electrical Supply Jobbers' Association and the Electrical Manufacturers' Association have been for several years carrying on educational work among their respective members. The National Electric Light Association carries on similar work for the benefit of its company members and for the benefit of the employes of these companies. The contractor-dealers have joined forces in their California association to co-operate in educating each other, in developing ways to improve their salesmanship, their accounting, and their other business methods. But the Contractor-Dealers' Association is not as strong financially as the association in the other branches of the industry and it needs help to actively carry on this educational work, and it was to furnish this aid and co-operation that the campaign plan was proposed and adopted.

The campaign is under the direct supervision of an Advisory Committee, composed of men from all branches of the industry. It now consists of' Chairman, Lee H. Newbert, manager of the commercial department of the Pacific Gas & Electric Co. of San Francisco; vice-chairman, G. E. Arbogast, F. E. Newberry Co., Los Angeles; R. M. Alvord, General Electric Co., San Francisco; D. E. Harris, Pacific States Electric Co., San Francisco; M. L. Scobey, Home Electrical, San Francisco; A. W. Childs, Southern California Edison Co., Los Angeles; H. C. Reid, Pacific Fire Extinguisher Co., San Francisco; K. E. Van Kuran, Westinghouse Electric & Manufacturing Co., Los Angeles; A. E. Wishon, San Joaquin Light & Power Co. of Fresno.

The Advisory Committee appoints field men whose duty it is to visit the contractors and dealers, helping them to improve their business methods, including accounting, sales, advertising and general store appearance. These field representatives endeavor to bring about a closer co-operation between the central stations and the dealers and among the dealers themselves by promoting a better acquaintance between the different individuals. They explain to the contractor-dealer the value of tying in with manufacturer's and central-station advertising. In addition, they show the non-member contractor-dealers the advantages of membership in the organization and endeavor to secure their co-operation. They also encourage the contractor to use good materials and workmanship and standard methods of estimating, accounting, etc.

Results of First Year's Work.

During the past year the field representatives spent considerable effort in increasing the membership of the Contractor and Dealer Association. New locals have been established at Modesto and Marysville, and now there is a local in practically every section of the state. A special campaign for new members was conducted in southern California by which the membership there was increased over 50%.

Another important phase of the field representatives' work has been improving the relations between the managers and employes of the central stations and the contractor-dealers. In the course of the year 410 calls were made on 130 central-station offices, the objects of the campaign discussed and efforts put forth to bring about closer co-operation with the local contractor-dealers. In nine towns a feeling of antagonism existed. In five this feeling has been straightened out and a spirit of co-operation now exists; in three material improvement has been made, while in the remaining one steps are being taken which it is expected will improve the situation.

The central-station men have in most cases been quick to recognize that a greater number of properly equipped and well operated electrical stores are essential to giving the very best service to the public and therefore to building up to the greatest extent the use of electric power company service. As a result several central stations have changed their policies with reference to the sale of appliances so that they are now selling on an ethical retail basis and under policies that encourage the dealers to be more active in developing the use of electrical service.

Arrangements have been made whereby 28 contractor-dealers have been privileged to display appliances in the power company offices in their towns. In 14 towns the lighting company is mailing out with its bills advertising matter for the dealers. In one town the lighting company is working with the dealers in an appliance campaign employing several solicitors. In

another town a saleswoman is employed by the dealers and the central stations to make sales for both. In another, the lighting company made a big Christmas display in its office, selling the appliances for the dealers. There is no doubt but that the encouragement thus given the dealers is largely responsible for the great improvement in their merchandising activities.

A great deal has also been done towards improving the feeling between the dealers themselves. As a result, 12 dealers were recently engaged in two different house to house campaigns. In addition to these campaigns 14 other dealers are also doing house to house soliciting.

During the year 21 dealers have moved into better stores in better locations. Thirteen dealers have made major improvements in their stores involving extensive remodeling, while 23 have materially improved their stores by entirely re-arranging them. Five dealers have rebuilt their show windows and 46 have shown marked improvement in trimming their windows. Twelve new retail stores have been opened during the year and there are six contractors who although they have no stores are actively pushing the sales of appliances. As a result of these various improvements these dealers are now in a position to greatly increase their sales of appliances.

Until after the middle of the year the definite policy covering the advertising work of the campaign was not fully determined and put into operation. It now operates on the basis that the central stations use campaign business building advertisements in all or a portion of their regular newspaper space. For their use, copy is prepared of a conservative yet convincing nature and distributed simultaneously throughout the state. At the same time copies of the proposed advertisements are mailed to every contractor-dealer with a request that each one get in touch with the local representative of the central station in his locality and ascertain on what dates and in what publications the various advertisements will appear. They are further requested to prepare corresponding but more specific advertisements of their own and to have them appear on approximately the same dates as the more general advertisements of the central stations. With their windows trimmed to display the appliances advertised and their salespeople alive to the week's special endeavor, the dealers usually experience a stimulation in the sale of the appliances thus co-operatively exploited.

Plans for 1919.

The war is now over and in contrast to the abandonment of association activities in many other trades, the California Association of Electrical Contractors and Dealers is still in existence and stronger than ever, and the organization of the California Electrical Co-operative Campaign is intact and in operation. There exists, therefore, an organization which has weathered adversity and which has a firm foundation on which to build further co-operative work and thereby give assistance to the various branches of the electrical industry in California during 1919.

During the coming year the plan of furnishing suitable advertising copy to central stations and encouraging the dealers and contractors to tie in with this advertising will be continued on an even larger scale. In addition, the Advisory Committee will organize a staff of competent, experienced solicitors to be employed by various dealers in special campaigns where the field does not warrant the permanent employment of solicitors.

The committee will also organize a demonstration or electrical show staff to meet demands for assistance in the operation of co-operative appliance campaigns and demonstrations. In this, as in the case of the solicitors, the Advisory Committee expect to pay from the campaign fund only organization and general supervisory expenses. The individual firms using the services of the solicitors, demonstrators, and show organizers will be required to pay the main items of salaries, commissions and traveling expenses. These plans are advantageous in that well trained and experienced assistants can be secured by the contractor-dealers for short periods at reasonable cost.

To assist in encouraging the dealers to use and to send in appliance sales reports and to assist in such other work of the campaign as may be from time to time delegated to them, a salesman's auxiliary will be organized. It will be composed of traveling representatives selected from the organizations of contributing jobbers and manufacturers and who with the consent of their principals will in addition to their regular duties give some special attention to the work of the campaign. This Salesmen's Auxiliary will be a fully organized body with a chairman, three vice-chairmen and a secretary, reporting and responsible to the Advisory Committee.

Throughout 1919 it will be the earnest endeavor to bring about every condition within the power of the Advisory Committee that will tend toward building up the contractor-dealer. To that end the field representatives will continue their endeavor to add to the membership of the California Association of Electrical Contractors and Dealers. As this Association is of a permanent nature and one in which the main object is the development of its members by educational methods, the Advisory Committee feels it desirable to increase that Association's membership to the greatest possible number so that the educational work undertaken by the Committee may be carried on and cover the broadest possible field when the Co-operative Campaign shall have accomplished its purpose.

CENTRAL STATION HOLDS AUCTION SALES FOR EMPLOYES.

Philadelphia Company's Plan Allows Employes to Purchase Left-Over Stock at Low Figure.

Once or twice a year, according to the amount of goods on hand, the Philadelphia Electric Co., of Philadelphia, Pa., holds an auction sale for the benefit of its employes. This sale is conducted in connection with the main section meeting of the National Electric Light Association. The articles which are auctioned are either shop-worn goods, discarded or more or less obsolete types of electrical goods. Because of this, these could not be sold to customers as many of the parts cannot be supplied readily, and the goods are not as modern as other articles of the same kind that are on sale.

The articles placed on sale vary from washing machines and carpet sweepers to toasters, broilers, hair curlers, lamps and lamp shades, irons, etc. The employes are told the exact condition of the various articles and that they are discarded or obsolete types. All are in excellent repair and where parts are missing, like cords, these facts are stated.

No effort is made to get big prices nor to obtain any profit. Yet, some articles are sold at prices very near the retail cost. Everything is done on a cash basis. Usually a hundred or more articles are placed on sale and in most cases the bidding is spirited. Fre-

quently where a prospective buyer is unable to get some article and is a persistent bidder on others without result, he or she is "knocked down" another article on the first bid. Every effort is made to dispose of the goods to as many buyers as possible. The sale is restricted to the employes of the company. The employes have taken to this method of obtaining electrical appliances and auctions are always well attended, and bidding is keen and good-natured.

MAINE CENTRAL STATION FINANCING HOUSE-WIRING CAMPAIGN.

Results Thus Far Very Promising—Appliance Campaign Contemplated in Near Future.

The Cumberland County Power & Light Co., of Portland, Me., recently inaugurated a house-wiring campaign that is proving very successful in increasing the percentage of houses in its territory that are wired for electric service. This campaign is being carried out along the same lines as the former campaigns of this central station—that is, by a co-operative effort on the part of the electrical contractors in the district and the company. The proposition in this instance allows the customer to pay for the wiring in 12 monthly installments, the company assuming the financial responsibility by paying the contractor cash for his work when the job is completed.

This company also intends to start a house-to-house appliance campaign about April 1, feeling that a good profit may be derived from this, besides increasing the current consumption on its existing lines at this time.

UTILITY COMPANY PURCHASES ELECTRIC AND GAS PROPERTY.

Washington Coast Utilities, Seattle, Wash., has purchased the electrical, gas and ice properties of the Key City Light & Power Co., at Port Townsend, Wash., all of which will be operated under a 50-year franchise granted the purchasing company by the city. The electric property bought is a distributing system, purchasing energy from the Northwestern Power & Manufacturing Co., Port Angeles. F. D. Nims, general manager of Washington Coast Utilities, states that some new extensions at Port Townsend are contemplated. J. M. Kinkaid, formerly in charge there for the Key City company, becomes local manager for the purchasing company.

The Northwest Electric Water Works Co., a subsidiary of Washington Coast Utilities, has recently moved a 500-kw. turbo-generator set from its steam plant at Montesano, Wash., to the plant of Hoquiam Sash & Door Co. It will be operated to supply energy for the electric plant and water works.

MANY NOVEL STUNTS DEVELOPED IN WASHING-MACHINE CAMPAIGN.

Features of Commonwealth Edison Campaign to Sell 3000 Electric Washers During Year.

The Electric Shop of the Commonwealth Edison Co., of Chicago, has set as one of its goals for 1919 the sale of 3000 electric washing machines, a considerable task even when compared with the previous remarkable achievements of this progressive central-station company. It is apparent from the results thus far, however, that this mark will be reached and probably passed, for at present an average of 15 machines are being sold daily. To accomplish this, E. A. Edkins, manager of the Electric Shop, and his corps of able assistants are exerting every effort, and a visit to the Electric Shop at Clark and Adams streets discloses many new and novel show-window, advertising and exhibition displays.

In several of the windows machines can be seen in operation, while in one of the large show windows a number of tags explaining the important features are placed in prominent places, each attached with a ribbon to that particular part of the machine described. In a recent display, ten colored laundresses, selected chiefly for their physical and natural qualifications, were employed. In alternate windows, the fat, lazy-looking ones were seen washing with the old-fashioned tubs and washboards, while the neater, lighter and more active-appearing women were placed in the other windows with electric washers. The comparison between the old and modern methods was thus clearly and very effectively shown to the passer-by and resulted in attracting large crowds to the windows.

In the interior of the store, washing machines are placed in practically every prominent place. Midway down the main aisle a powerful floodlight projects its rays upon a skeleton Federal washer across the aisle. At the end of the aisle several machines, crated and ready for delivery, are placed, bearing this sign, "Let Us Deliver This Machine to Your Home."

The machines are sold on the time-payment plan and a certain number of Federal profit-sharing coupons are given with each purchase. To stimulate the sale of washers a large supply of floor lamps was purchased at a very reasonable figure which permits their being exchanged for the number of coupons received with the washer. The customer is therefore enabled to acquire both an electric washer and a floor lamp for the same price.

Start of Recent Delivery of Washing Machine by Airplane.

In our March 15 issue we mentioned briefly another novel stunt of this washing-machine campaign—the delivery of an electric washer to the purchaser by an airplane. The accompanying illustration shows the start of this flight. Lieut. Ralph C. Diggins, the aviator, purchased the airplane—a Dayton-Wright training plane—from the Government. As shown, the washer, weighing about 180 lb., was strapped in the front cockpit for delivery.

Operating Practice

Earthing Overhead Grounded Conductors—Voltage Regulation Capitalized — Linemen's Portable Electric Lamp

METHOD OF EARTHING OVERHEAD GROUND CONDUCTORS.

Simple Expedient Followed by Minnesota Transmission Company.

The efficiency of an overhead grounded conductor, as with the lightning arrester, depends upon the resistance offered to a discharge to earth. The earth resistance should be low, the path to ground the most direct, and the arrangement of the earth wire such as to offer a minimum skin effect and inductance to the discharge. In grounding overhead grounded conductors it has been found that it is necessary to earth the conductor at every other pole where the spans are very short and, better still, at every pole.

The method of grounding plays an important part in determining the resistance and life of the ground, hence the return of the money invested in the overhead grounded conductor. Ground rods are expensive to install, as are also ground plates, and may necessitate maintenance. A way to overcome this, and a practice followed by one of the largest transmission companies in Minnesota, is to bend the ground wire into an S several times, and bury this S under the pole. This method is claimed to be cheap and effective.

VOLTAGE REGULATION CAPITALIZED.

Effect of Voltage Regulation Upon Service and Its Cost.

In the design of new power plants, or remodeling of existing plants, the aim of the designing engineer is to select such equipment as will result in the desired energy being delivered to the bus bar at the minimum cost. Many auxiliary devices are included to assist in obtaining the maximum efficiency. A small fraction of 1% increase in plant efficiency often justifies the expenditure of additional capital for the higher efficiency units that the cost of energy per kilowatt hour as delivered to the bus may be a minimum.

In laying out the distributing system, however, the same effort is rarely made to carry efficiency through to the consumer to maintain constant normal voltage at the recording meter—or are the power plant economies being consumed by the line losses in the distributing feeders. Voltage drop and the corresponding line loss can not be entirely eliminated, but by analyzing the load conditions to be taken care of on the various feeders and by laying out the distributing system with the same care as was used in the design of the power plant the losses can be reduced and the drop compensated for so that efficiency of operation will not stop at the bus but will be carried through to the consumer.

The voltage of a generator or a number of generators may be maintained automatically at normal for all conditions of load at the station bus or at any one center of distribution on the system by means of a generator voltage regulator. Where there are a number of feeders radiating from a station this method of regulation, however, will not be satisfactory unless all of the feeders are laid out for negligible voltage drop which generally is uneconomical. Usually the feeders are of different lengths and the power demands occur at different intervals so that the voltage delivered at the centers of the several feeders will vary widely. It is practically impossible, therefore, to raise or lower the station bus so that the voltage at each load center is proportionate to the demand at that center. In order to provide for efficient operation of the distributing system it is essential that each feeder should be considered as a unit. The system can be made very simple and economical if care is exercised at the time the initial layout is made, and many existing plants could probably reduce the distributing costs and improve their service by thoroughly investigating their feeding systems with a view toward making them more symmetrical and of uniform regulation. Recording voltmeter charts taken at frequent intervals at various points on each feeder provide a means for detecting voltage irregularities in the feeder which if uncorrected may become magnified and not only impair the service but appreciably effect the revenue.

In laying out a new system, or reconstructing an old one the area to be lighted should be divided into districts and the maximum load to be handled in each district should be determined, bearing in mind the advantages of having, in so far as possible, the feeders as nearly equal in capacity as practicable. This insures symmetrical switchboards and feeder equipments and simplicity of maintenance. It is usual when selecting or subdividing the total area to be lighted to take into consideration the actual anticipated loads in each subdivision, so that the laying out of feeders is by no means a mere stringing up of copper wherever a light is needed. Forethought in this respect often saves considerable expense in the future growth of the system. One district may be 90% loaded while another may be only 25% loaded. The latter, however may be of such a character as to lead the lighting company to believe that there are prospects of a load equally as great as in the former. If the latter feeder is a duplicate of the first it would, of course, have much less drop, but in the end if care has been exercised the extra cost and fixed charges of copper necessary to handle the anticipated load is cheaper than if only sufficient copper were installed to take care of the actual load and a smaller percentage of anticipated load. In laying out the feeder and the mains, that cross section of copper should be used which is most economical, that is, the cost for the conductor distributed over a period of time corresponding to the life of the feeder should equal the cost for loss in energy due to the drop. The value of feeder regulation must be taken into consideration, however, as it would not be possible to use the most economical size of conductor without providing some form of regu-

lation if the drop at maximum load is to be maintained within a reasonable percentage.

The choice between voltage regulators to compensate for the voltage drop in the feeder and the installation of conductors of such size as to provide negligible drop depends on the relation between the cost of the line using the most economical conductor and the regulator plus the cost of losses in the line and regulator and the cost of the feeder using the larger conductors to reduce line drop plus the line losses. Consideration, however, should also be given to the fact that the regulator will compensate for the variations in supply voltage which can not be accomplished by the use of larger conductors. The installation of a regulator will oftentimes be more economical even if the total cost somewhat exceeds the cost of the heavier conductors.

To illustrate, assume that it is necessary to install a single-phase 2300 volt lighting feeder of 75 ampere capacity, the load to be equivalent to full load four hours per day, 300 days per year. The most economical size of conductor would be No. 1 on the basis of 15 year life for the feeder, copper at 20c per lb. and allowing 2% for taxes, 5% for capital invested, 15 cents per pound for scrap copper, and energy to supply losses at $.0125 per kilowatt-hour, as well as proper charges for erection and removal. The cost per mile for the feeder would be approximately $184, and the drop would be 4%. If not corrected, this drop, without considering the drop in the secondary distribution, would mean a reduction of over 12% in candlepower of the lamps and a loss of over 6% in revenue to the central station, or on the basis of ten cents per kilowatt-hour the annual anticipated revenue of $21,000 would be reduced $1260. If larger size conductors are used to reduce the line drop it would necessitate the installation of 350,000 c.m. cable to maintain regulation within 1% at the center of distribution, such as can be accomplished by installing a regulator. This would cost approximately $248 per mile. On the other hand, if No. 1 conductors and a regulator to compensate for the drop to the load center are used the regulator including the cost for losses and installation would increase the cost of the feeder from $184 to $278. Unless the supply is subject to fluctuations such as occur in feeders tapped from transmission lines making a regulator necessary, the lower cost favors the installation of the 350,000 c.m. cable.

If, however, the feeder were two miles long, all other factors remaining unchanged, the full load drop would be 8%. To maintain regulation within 1% at the load center without a regulator would necessitate installing 1,500,000 circular mil cable at a cost of $354 per mile, whereas the extension of the feeder would cut the charge for the regulator in half making the cost to cover the installation of No. 1 conductors and regulator $231 per mile, or a difference of approximately 50% in favor of the latter installation. If the feeder were three miles long, the saving in favor of the use of a regulator would be even more marked. In fact, the minimum cost is obtained when the entire range of the regulator is utilized in compensating for line drop. Inasmuch as the regulators selected would provide 10% boost and 10% lower, a total range of 20%, the feeder could be extended for a distance of 5 miles and normal voltage would be maintained at the center provided the bus voltage was held constant at a value which would permit the regulator being in the neutral position when the load on the feeder was 50% of maximum load. In other words, the regulator should lower the bus voltage 10% at no load, lower 5% at quarter load, be at neutral at half load, it should raise the bus voltage 5% at three-quarters load, and raise it 10% at full load. In this way the maximum benefit to be derived from the regulator can be obtained.

Voltage regulators are not necessary to maintain service, and if they are considered merely as a means to improve the quality of service furnished the consumer, so that the household appliances may be used most efficiently, they may be justly referred to as a luxury, as apparatus designed to provide desirable refinements in service. When their value to the central station is considered as a means for raising the efficiency of the system, for obtaining a greater return on invested capital, for effecting economies in feeder construction as well as improving the service they cease to be a luxury and become a necessity. In laying out the feeding system, therefore, it is essential that each feeder be considered separately, its load analyzed, anticipated as well as present, with the same care as is given to the design of the station, and by providing the proper form of voltage regulation, efficiency of operation will not stop at the bus but will be carried through to the consumer.

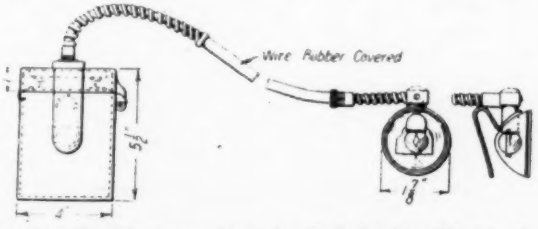
The above remarks were made by Frank Hershey, General Electric Co., in an interesting paper entitled, "Voltage Regulation of Distributing Feeders as a Means of Improving Central Station Efficiency," read before the February meeting of the Ohio Electric Light Association held in Cleveland.

PORTABLE ELECTRIC LAMP FOR LINEMEN.

Safe and Convenient Unit Used by Philadelphia Electric Company.

One of the greatest difficulties encountered by linemen and troublemen doing work at night is on account of the darkness. In patrolling a line in city streets or alleys, when an automobile is employed, some companies use a search light installed upon the radiator of the automobile, and so controlled that it may be made to play upon a pole, a crossarm, an insulator, etc. When the lineman works upon the pole the light directs its rays where needed.

However, this method does not always serve. It is often desirable, especially where only one man is on a job, to have a light directly where the work is being done. Time will be saved, and the likelihood of accidents occuring will be reduced, if the lighting unit be self-contained, may be made part and parcel of the lineman in the same way that is a miner's lamp. The accompanying illustration shows a form of portable lighting unit employed by the Philadelphia Electric Co. for its linemen, troublemen and inspectors. This type of lamp may be used without in any way interfering with the safety, actions or work of the lineman. It may be hung from the belt or mounted on the head.



Portable Electric Lamp Used by Philadelphia Electric Co.

Contracting-Construction

Croft's Second Article on Accurate Laying Out of Conduit Fittings—The Housing Situation and the Wiring Campaign

MAKING MEASUREMENTS FOR FITTING CONDUIT.

Finding Length of U-Bends, Irregular Contours, Angular Offsets, Connections, Etc.

By Terrell Croft.

[*This is the second of three articles discussing methods of accurately measuring and laying out conduit work. These articles fit in with several series of articles on conduit construction by this well known writer that have appeared in* Electrical Review *within the last 15 months as follows: "Methods of Bending Conduit,"—7 articles in issues of Jan. 12 to Feb. 23, 1918; "Some Comments on Conduit Benders,"—4 articles in issues of April 27 to May 18, 1918; "Bending Racks and Roll Benders for Large Conduit and Pipe,"—5 articles in issues of June 22 to July 20, 1918; "A Few Facts About Conduit Fishing,"—7 articles in issues of Aug. 24 to Oct. 5, 1918; "Attaching Conductors to Fishing Wires and Pulling-in Lines,"—3 articles in issues of Jan. 11 to 25, 1919. In view of the steady increase in conduit construction, electrical contractors and wiremen will find these series of articles of considerable value.*]

In Determining the Length of Conduit Necessary for a U-Bend (Fig. 5) the total length of the tube required is obtained by adding the sum of the lengths

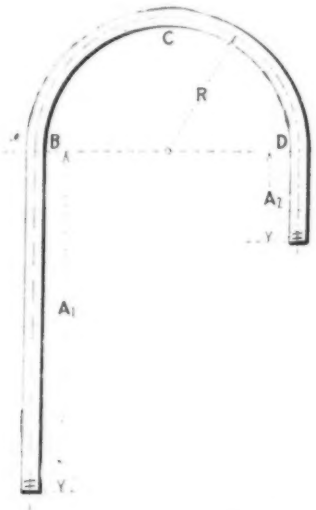


Fig. 5.—Finding Length of Conduit Required for a U-Bend.

of the two arms A_1 and A_2 to the length of the curved portion *BCD*. The length of this curved portion is computed by multiplying the radius R by the constant 3.1416. The measurements should be made along center lines.

To Ascertain the Length of Pipe Required for a Run Which Will Be of Very Irregular Contour, the most direct and accurate method consists in making a scale drawing of the tube as it will appear after being bent into finished form and then measuring along the center line to obtain the length. The length of the center line can be measured either with a tape or with a rotometer or measuragraph.

Where It Is Necessary to Find the Length of Conduit to Connect an Existing Fitting With a New Fitting to Be Located in an Existing Parallel Conduit Run, the procedure is indicated by Fig. 6. First obtain the distance X from the inner end of the thread in the first fitting (in one conduit run A) to the center line of the second fitting in conduit run B. This may be called an "end-to-center" measurement. Then to ob-

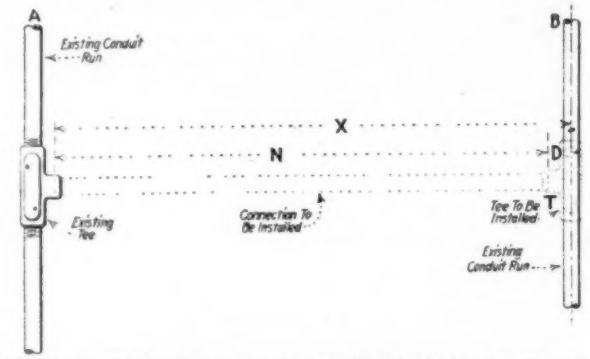


Fig. 6.—Finding the Length of Conduit Required for a Connection Between Two Parallel Runs.

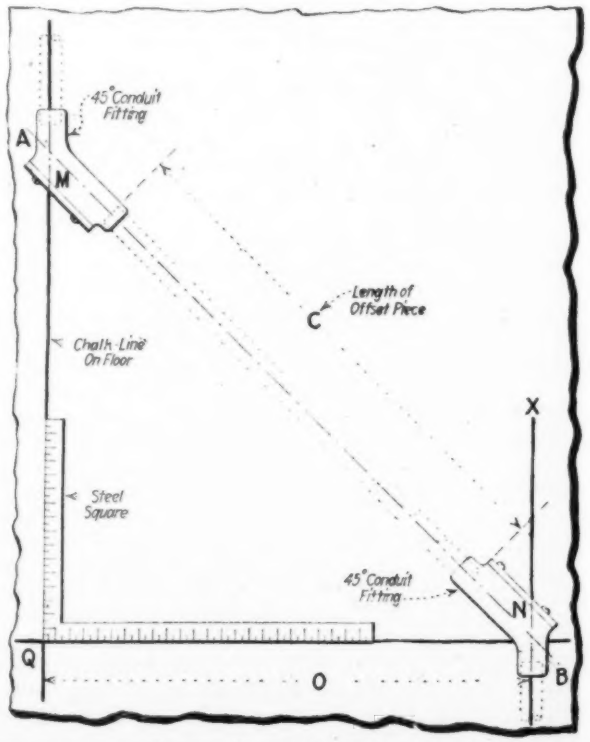


Fig. 7.—Finding Length of an Offset Piece by Trial by Laying Out the Fittings on the Floor.

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tain the proper length N of the nipple, subtract the distance D from X.

The Graphic Method of Determining the Length of Conduit Required to Connect Two 45° Fittings is diagrammed in Fig. 7, in which C is the length of the offset piece required. The procedure is this: First draw, either actual size or to scale, on the floor with chalk, two parallel lines AQ and XB representing the center lines of the two runs to be interconnected. Now draw the chalk line QB at right angles to the two parallel lines by using a steel square as indicated. Indicate on the lines AQ and QB the locations M and N of the fitting centers. Then draw the line AB through these centers. Now place the 45° fittings which are to be interconnected on the floor in their proper positions on the center lines, as delineated in Fig. 7. Measure the distance C between the ends of

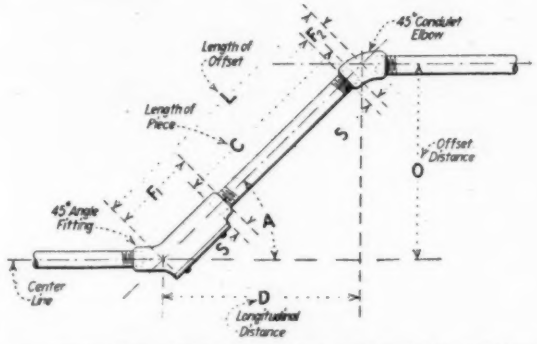


Fig. 8.—Illustrating Elements Involved in the Determination of the Length of a Piece for an Offset.

the threads in the two fittings, making proper allowance for the distance (shown as S in Fig. 1) which the conduit enters into the fitting.

To Compute the Length of an Offset Piece for a 45° Offset it is merely necessary to multiply the offset distance O (Fig. 8) between the centers of the two parallel conduit lines which are to be joined by the secant of 45°, which is 1.41. The value then obtained will be the length of the offset L. To obtain the length C of the offset nipple, subtract from L the sum of the distances F_1 and F_2 between centers and the outside faces of the fittings and add twice the distance S which the conduit enters each fitting.

Instead of using the secant of 45°, which is 1.4142, practical men often follow this rule: To obtain the length for a 45° offset, multiply the center-to-center or offset distance by 10 and divide by 7. This method is not quite as accurate as the one specified but is sufficiently so for practical purposes.

The secants of angles other than 45° are: 60°, 1.15; 30°, 2.00; 22½°, 2.61. How these values may be used in obtaining the length of offset where the offset angle is other than 45° will be obvious from a consideration of the preceding statements.

(To be continued.)

HOUSING PROBLEMS AND THE "ELECTRIFY YOUR HOME" CAMPAIGN.

While New Construction Lags Remodeling of Old Buildings Will Be Active, Affording Good Opportunity for House-Wiring Business.

There are many results of the war that, despite their individual and even local application, are regarded as vital issues. Not the least important of these is the housing problem. Largely because of the Government restrictions placed on building materials during the war, there have been practically no dwellings erected in the past two years. The consequent situation is startling.

The average number of buildings erected yearly before this country entered the war was between 300,000 and 350,000. Building contractors base their calculations for the next 12 months on the erection of not less than 700,000 new homes, just double the number of former years. The Government, somewhat more optimistic, or pessimistic, according to the point of view, sets the estimate at 1,000,000. According to officials in real-estate circles and in the metropolitan public utilities who are in a position to know, there are, in the city of New York alone, 30,000 families searching almost hopelessly for homes. And New York reflects the situation that exists in the other large cities.

With these conditions existent and the Government restrictions on all building materials lifted it was believed by many that there would be a surplus of labor, hence one bugaboo of the building question would be dispelled. It was furthermore believed that with restrictions off the prices of building materials would decline.

On the contrary, it is a fact that labor wages are almost certain to remain at the old scale—if they do not climb still further. In fact, in the New York City papers there recently appeared the notice of an increase of $1 per day to all classes of labor in the building trades. This was the decision of Supreme Court Justice P. Henry Dugro, umpire, selected by the Building Trades Association and the United Brotherhood of Carpenters and Joiners to consider their dispute over wages.

The Government says the best time to build is now. The prevailing conditions of labor and material costs should be taken advantage of, because it is certain that prices, in the main, will be at even a higher level.

Some of the great cement manufacturers, whose ears, figuratively speaking, are always close to the ground, report an increasing number of calls for estimates of building construction, which is a most hopeful condition.

In addition to the proposed construction of new houses, thousands of homes (more than the annual average number) are slated for remodeling, redecorating and other renovating. In most of the larger cities the shortage of suitable houses has driven the average American to become a home owner, and realty companies report many sales transactions and many more pending the final breaking of winter.

The great demand for modern apartments in the larger cities is much greater than the supply available, consequently many older buildings are likely to be rehabilitated, including the installation of up-to-date wiring systems and modern sanitary plumbing equipment.

The Society for Electrical Development, New York City, has inaugurated a national campaign, scheduled for April 1 to May 15, called "Electrify Your Home," which is destined to stimulate trade activities. This dovetails into several other spirited national movements to hasten prosperity undertaken by the Government and various trades and mercantile associations in which publishers of the country are actively co-operating.

Electrical contractors should find this campaign of special value in stirring up house-wiring business until the revival of new-dwelling construction again becomes normal.

New Appliances

New Glass Bowls—Furnaces for Laboratory Use—Spotlight Switch — Fan Developments — Detachable Socket Buttons

New Line of Glassware for Semi-Indirect Fixtures.

The fixture illustrated herewith shows a new and interesting design in glassware designed by the Beardslee Chandelier Manufacturing Co., Chicago, Ill. The distinctive feature of this glassware is its simplicity of outline and the introduction of only sufficient ornamentation to relieve this outline.

Translucent Glass Bowl of New Design for Semi-Indirect Fixtures.

The bowl is made in 10 by 12, 12 by 14 and 14 by 16-in. sizes and is so designed as to lend itself readily to a wide variety of fixture designs. A particular feature of the bowl is its depth, which permits its being used as a single unit with a type C Mazda lamp of large wattage.

This bowl is made in white glass, satin-finished on the outside, and will be offered to the trade in a number of special designs of fixtures which the Beardslee Chandelier Manufacturing Co. is developing. The glass only may be purchased by the trade at an attractive price.

Fig. 1.—Electric Tubular Furnace.

Laboratory Furnaces Made by Edison Electric Appliance Company.

In research and testing laboratories cleanliness, convenience and perfect control of heat are not only desirable but in many cases absolutely necessary for reliable results. The use of electric heat being much superior in every one of these particulars to any other method of heating apparatus, there has developed an opportunity for using electric furnaces for this purpose. The Edison Electric Appliance Co., 5660 West Taylor street, Chicago, Ill., has brought out a number of laboratory furnaces to meet these requirements.

Fig. 2 shows a crucible furnace of compact size. Its crucible chamber is 2 11/16 in. in diameter by 2 1/16 in. high, which is large enough to take care of any ordinary porcelain or platinum crucible for general analytical or special research work. The furnace has a fire-

Fig. 2.—Electric Crucible Furnace.

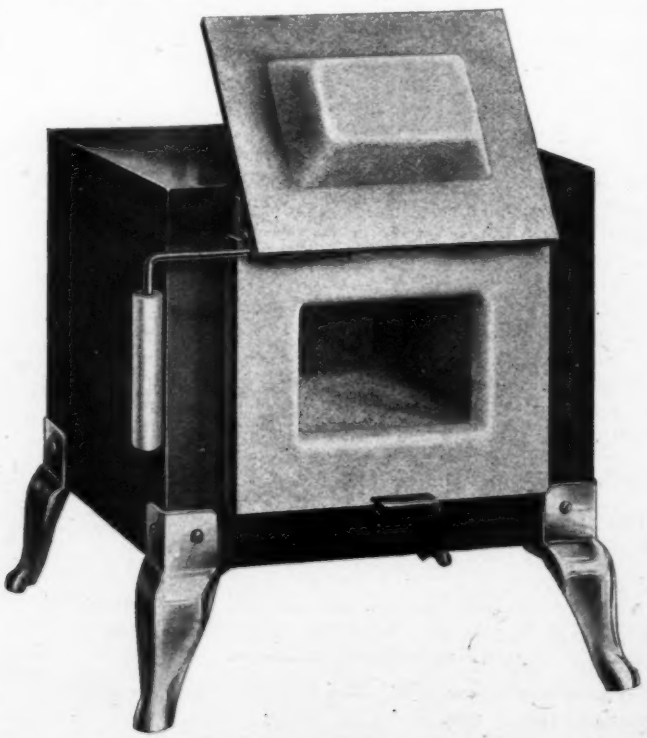


Fig. 3.—Electric Muffle Annealing Furnace.

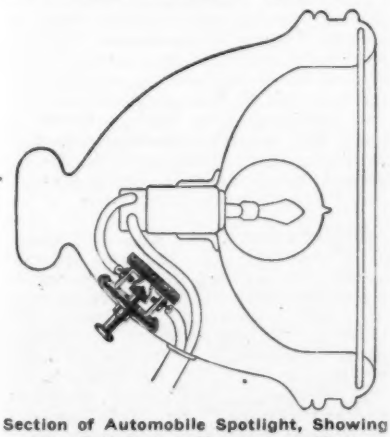
clay top. It takes only 350 watts at 110 volts, but is capable of maintaining a temperature of 180° F. Fig. 1 shows a horizontal tubular furnace of the same voltage consumption and temperature rating. It has a muffle of 1¼ in. inside diameter and is especially adapted for checking pyrometer couples, organic and inorganic combustion work.

Fig. 3 shows a muffle furnace of wider application. While it may be used for a variety of laboratory purposes, it is also adapted for annealing work, as for bluing, annealing and perforating of high-speed steel, special heat treatment of carbon steels, etc., where absence of scale, warping and elimination of dirt that is common to oil or gas fuels is to be prevented. This furnace is said to be ideal for the treatment of delicate dies and tools where an exact control of the temperature is essential for proper results. It is made in four sizes with the muffles ranging in size from 2½ by 3 3/16 by 5½ in. up to 5¼ by 7½ by 12½ in.

All these three types of electric furnaces can be regulated by an external rheostat to give constant temperatures up to 1,800° F. These rheostats are substantially built and well ventilated. They may be mounted on either a horizontal or vertical surface convenient to the furnace or to a pyrometer used for indicating the temperature. Rheostats and pyrometers are furnished separately from the furnaces.

New Spotlight Switch for Mounting on the Shell.

One of the new developments of the wiring device department of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is a push-and-pull spotlight switch made for mounting within the shell of a spotlight. Many years' experience in making switches for the automobile trade has proven to this company that a satisfactory automobile lighting switch must have large "wiping" contact surfaces to prevent excessive contact resistance, and that the contactor must "float" on the operating shaft so that vibration and side strain on the button will not cause the lights to flicker. Both of these features are incorporated in this new switch.



Section of Automobile Spotlight, Showing New C-H Switch Mounted on Shell.

The insulating parts are made of fibre; the frame, of stamped steel; the contacts, of brass; and the contactor, of phosphor bronze. These parts are riveted together into one solid unit which does not loosen or change alinement when subjected to vibration or strain. The mechanism is not enclosed, because this switch is installed inside of the spotlight shell with the button protruding. Either rivets or machine screws can be used to fasten the switch to the shell. No plate is required; drilling one hole the size of the button and two for the rivets or screws permits mounting the switch as shown in the accompanying illustration. This also shows the simplicity of the wiring.

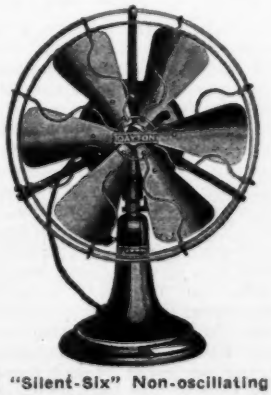
Developments in Dayton Fans.

Following a reorganization of the Dayton Fan & Motor Co., Dayton, Ohio, there have been announced a number of improvements or refinements in its line of fans. This company has been making fans and small motors for 28 years, during which time its product has become well known to the trade. To meet growing demands the company is making extensive additions to its equipment.

Dayton Square-End Blade Compared With Ordinary Round End.

In general features the 1919 line of fans corresponds with the 1918 output, including 9, 12 and 16-in. desk and bracket fans, both oscillating and non-oscillating, and both direct-current and alternating-current types of standard 110-volt circuits; they are also 32 and 64-volt direct-current fans especially adapted for use on farm lighting systems, also ceiling fans for standard voltages. All 9-in. fans are made with four blades only, while the 12 and 16-in. fans are made with four and also with six blades. The six-blade fans run at lower speed than the four-blade and therefore so much more quietly that they are called the "Silent Six."

Four-Blade Dayton Oscillating Desk and Bracket Fan.



Dayton "Silent-Six" Non-oscillating Fan.

A distinct feature of Dayton fans is the square-end blade. It is claimed that this type of blade produces 30% more breeze than the round-end blade by actual test. All Dayton fans have a pleasing outline and finish; the ceiling fans have been decorated in good taste. Mechanically and electrically the fans are built very ruggedly so that the company has appropriately now adopted for them the name "Durable Dayton." This is one of the reasons for the large demand for these fans, which has extended to foreign countries as well.

One of the Ceiling Fans in Large Demand.

Bryant "Wrinklet" Sockets with Detachable Buttons.

The Bryant Electric Co., Bridgeport, Conn., manufacturer of the "Wrinklet" interchangeable line of lamp receptacles and sockets, has improved its push-button socket designated as List No. 81, by making both buttons detachable. This is accomplished by molding a threaded stud laterally into each of the buttons, the stud in the black or "off" button being of a larger diameter and a different thread from the stud molded in the red or "on" button. This feature prevents transposition of the two buttons after the socket has been inserted in the fixture. Sockets with detachable buttons are necessary for installation in husks, socket covers, and other restricted locations. And, as the "Wrinklet" line embraces a complete variety of different caps and bases, interchangeable with all other "Wrinklet" bodies, the advantage of this socket will be readily appreciated.

Socket With Detachable Push Buttons Especially Suitable for Use With Socket Covers or Husks.

Trade Activities

Wellman-Seaver-Morgan Exhibits Tire Applying Press—Waterloo Electric Supply in Larger Quarters—Literature

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has received an order from the Hydro-Electric Power Commission of Ontario for two 45,000-kv-a. vertical water-wheel generators of 12,000 volts, 3-phase, 25 cycles, for its Queenstown Development. These will be the largest water-wheel generators ever constructed and indicate that the Hydro-Electric Commission believes there is no time like the present for construction work.

Exhibit of W-S-M Tire-Applying Press.—It is no doubt true that the majority of people have never stopped to think how solid rubber tires are put on and taken off wheels. That they do not slip unresistingly into place is evident. Tires being held on the wheels by friction only, mounting and demounting requires from 50 to 200 tons pressure. Where do truck and tire dealers get this force? To answer this question, The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has been holding, in co-operation with the Cleveland Trust Co., an educational exhibit on the bank's property at Euclid avenue and East Ninth street, one of the most prominent street corners in Cleveland. A 200-ton W-S-M tire-applying press was installed and demonstrations have been given of the actual mounting and demounting of tires. The exhibit was attractively arranged with oil-painted posters and flood-lighted at night. Grouped around the press were various sized tires up to the largest solids built. These tires are supplied by the tire manufacturers which are furnishing the W-S-M press to their dealers. The list includes the following tires: Brunswick, Firestone, Goodyear, Hood, Kelly-Springfield, Kokomo, Mason, McGraw, Owen, Polack, Republic, Sterling, Swinehart and United States. The view herewith shows the exhibit and a group of interested spectators watching the operation of mounting a tire. The press was run by a 5-hp., 220-volt, direct-current Westinghouse motor.

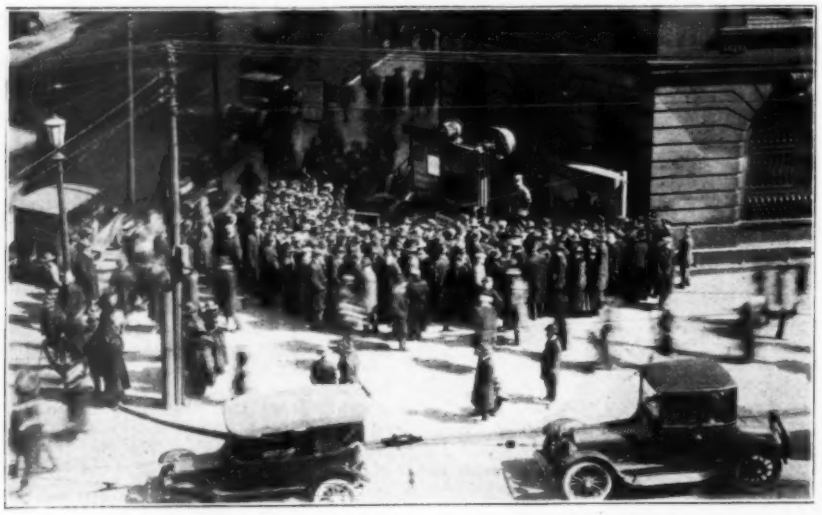


Exhibit and Demonstration of Tire-Applying Press for Heavy, Solid Truck Tires.

Waterloo Electric Supply Co. announces its removal from 25 Bridge street to larger and more elaborate quarters at 303-305 West Fourth street, Waterloo, Iowa. The company was established in the electrical merchandising business in Waterloo about eighteen years ago and since that time has witnessed a certain continual expansion until today it is one of the largest electrical merchandising concerns in the State of Iowa.

Electric Machinery Co., Minneapolis, Minn., has issued Bulletin No. 501, entitled "The New Book of E-M Synchronous Motors." This is a valuable publication dealing with the construction and use of synchronous motors and their many advantages. A brief review is given of the development of the synchronous motor, which up to a few years ago had but limited application due to the fact that its starting required a skilled operator so that the motor could be installed only in generating and substation plants. Through the development of the self-starting characteristics, the machine has now become much more adaptable for a variety of purposes, at the same time being made more rugged. In the bulletin the construction of E-M synchronous motors is described in great detail, and the greater part of the bulletin is devoted to a discussion of applications, characteristics and advantages. A very large number of illustrations are included, showing typical installations for such various purposes as driving pumps, air compressors, refrigerating machines, pulp grinders and miscellaneous machinery. There is also a considerable number of unique diagrams, showing how the copper losses in a line are reduced by placing synchronous motors at various points in the system. A strong argument is presented throughout the bulletin for the use of synchronous motors for improving the power factor of industrial installations. From the mass of information contained in this bulletin it is evident that it is one of the most complete presentations on the subject of synchronous motors.

Crystal Electric Washing Machine Co., Detroit, Mich., has witnessed a remarkable growth in its business during the past year, sales for the Crystal washing machine having increased 200% over the previous year and up to date the 1919 business record of the company shows an increase of 400% over the same period last year. Because of the continual increase in the demand for this machine, this concern has been compelled to seek new manufacturing quarters and its present floor space, although six times greater than in its former location, is already too small. C. Selbulske, general manager of the company, is of the opinion that the ever-increasing demand for Crystal washers is ample evidence that women are becoming more and more interested in labor-saving devices for the home, and is firmly convinced that the electric washing machine within a very few years will be regarded as a necessity in practically every home.

Sullivan Machinery Co., with works at Claremont, N. H., and general offices at Chicago, manufacturer of air driven and electrically driven mining and quarrying machinery, announces the appointment of Chester Mott as manager of its branch office at Denver, Colo., 837 Equitable building, succeeding Wallace T. Roberts, recently resigned. Mr. Mott has been associated with the company for a number of years in the capacity of sales engineer at its Spokane, Wash., office, and more recently at its Chicago office in charge of the company's interests in Iowa, northern Illinois and Minnesota. The company has also established a branch sales office and warehouse in Mexico, at Edificio Oliver No. 3, Mexico City. Joseph F. Bennet, for a number of years sales engineer in Mexico, associated with the El Paso branch, has been placed in charge of the Mexico City office.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Claremont, N. H.—The Town Council has approved an appropriation of $10,000, to provide for the operation of the street-lighting system during 1919. Electric energy is furnished by the Claremont Power Co.

Milton, N. H.—Farmington River Power Co. is considering plans for the erection of a new hydroelectric power plant on the Farmington River, near Windsor. The new plant is estimated to cost in the neighborhood of $500,000. L. W. Jones, Milton, is engineer.

Clinton, Mass.—In arranging its annual budget for 1919, the Town Council has approved an appropriation of $11,700 to provide for street-lighting during this period.

Leominster, Mass.—The City Council is understood to be considering plans for the establishment of a municipal plant for light and power purposes.

Spencer, Mass.—In connection with extensive improvements and alterations at the plant of the Allen-Traill-Webster Co., a quantity of electrical equipment is being installed, including insulators, and rewiring.

Springfield, Mass.—Fire recently destroyed a portion of the plant of the United Electric Light Co., being caused by an explosion in the boiler room.

Springfield, Mass.—A dynamo may be installed in the city's heating plant at the municipal group to furnish illumination for the City Hall, the Auditorium, the police station and fire department headquarters. The proposition was considered by the city property committee. The heating plant can easily be enlarged to provide for the extra space needed for a dynamo and extra boilers. The contract the city has with the electric light company for the lighting of the municipal group expires in June. Contracts for the lighting of all the schools also expire in June.

Providence, R. I.—Revere Rubber Co. has completed arrangements for the construction of the proposed power plant at its works, about 90x 100 ft., and a new 200-ft. stack. The structure will be of brick and reinforced concrete, and the entire work is estimated to cost $110,000. Contract has been awarded to the J. W. Bishop Co., Worcester, Mass.

Westerly, R. I.—Westerly Welding & Machine Co. has arranged for the establishment of a plant on Granite street, leased from the Wilcox Machine Shop.

Belmont, N. Y.—The Belmont Village Board has been instructed to call a special meeting in the near future for the purpose of voting on an appropriation of $10,000 for installing an electric lighting system for the village of Belmont, providing a suitable contract can be made with W. P. Clark for the purchase of electric current.

Albany, N. Y.—Wireless Specialty Apparatus Co., manufacturer of wireless apparatus and special equipment, has filed notice of an increase in its capital to $700,000, to provide for expansion.

Binghamton, N. Y.—Crowley Milk Co. has had plans prepared for the complete electrification of its plant. Contract for supplying service for operation has been let to the Binghamton Light, Heat & Power Co.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has been awarded a contract by McKinney & Co. for supplying electric service for operation.

Brooklyn, N. Y.—Electric Sealing Co., 15 Whitehall street, has had plans prepared for the erection of a one-story brick shop building, about 20x40 ft. to be located on Delevan street, near Van Brunt street.

Dresden, N. Y.—A proposition will be submitted to the taxpayers of Dresden village to raise sufficient money to install an electric lighting plant, the current to be furnished by the Taylor Chemical Works.

Goshen, N. Y.—A. E. Ludlam has had plans prepared by F. H. Dexter, 391 8th street, Brooklyn, for alterations and improvements in the power plant at 144 Reade street. The work is estimated to cost $10,000.

Huntington, L. I., N. Y.—Long Island Lighting Co. is understood to be arranging plans for a reduction in its lighting rates to consumers at Huntington and neighboring sections.

New York, N. Y.—Joseph Stern & Sons, Inc., 616 West 40th street, has had plans prepared for the construction of a one-story boiler plant, estimated to cost $4000. E. Broderick, 110 West 40th street, is architect.

New York, N. Y.—Sweets Co. of America, 416-18 West 45th street, has had plans prepared for extensions in its boiler plant and refrigerating building, to cost about $5000. Buchman & Kahn, 56 West 45th street, are architects for the company.

New York, N. Y.—The Board of Estimate has made application to the Public Service Commission for an appropriation of $557,060.50 to cover the cost of rapid transit construction during the second quarter of the year.

New York, N. Y.—Franklin Electric Manufacturing Co. has filed notice with the Secretary of State of the dissolution of the concern.

Rochester, N. Y.—Buffalo, Lockport & Rochester Railway Co. was sold at public auction on March 12, for a consideration of about $500,000, to W. A. Matson and W. W. Foster, Rochester, representing bondholders of the company. It is understood that the concern will be reorganized and operated by the new owners.

Thiells, N. Y.—In connection with the proposed improvements at the State colony, Letchworth Village, Thiells, Frank A. Vanderlip, president of the board of managers, has awarded miscellaneous contracts as follows: Contract to the Merrill Co., 98 Granite street, Boston, Mass., for the installation of new steam heating plant equipment for the central heating plant, at $46,984; to the Peter Keeler Building Co., 425 Orange street, Albany, for the construction of a new stack at the central heating plant, $18,750; to the Heine Safety Boiler Co., 11 Broadway, New York, for the installation of stoker and boiler equipment, at $67,500; to John C. Williams, Inc., 233 Broadway, New York, for extensions to underground piping distribution system at the heating plant, at $2979; and to Admirall & Co., 1 Dominick street, New York, for extensions in underground piping system throughout the institution, at $29,242. Lewis F. Pilcher, Capitol building, Albany, is state architect.

Utica, N. Y.—J. & M. Electric Co. has filed notice with the Secretary of State of an increase in its capitalization from $60,000 to $100,000 to provide for general business expansion.

Wellsville, N. Y.—The Board of Village Trustees has called a special meeting for the purpose of voting on an appropriation of $10,000, to provide for the installation of a new municipal electric lighting system. Service will be supplied by one of the local companies.

Dover, N. J.—Dover Boiler Works is planning the installation of electric welding equipment at its local plant.

Dover, N. J.—New Jersey Power & Light Co. is understood to be arranging plans for the resumption of the manufacture of ice in the plant of the Bernardsville Electric Light & Water Co., now operated by the New Jersey company. The plant will be electrically operated throughout, replacing the steam power heretofore in use.

Hackettstown, N. J.—Hackettstown Electric Light Co. has been granted permission by the Board of Public Utility Commissioners to place into effect increased rates for service.

Newark, N. J.—The Board of Education is considering plans for the installation of a new electric lighting

system in the Monmouth Street Public School.

Trenton, N. J.—In connection with various improvements planned at the Hotel Miller, a new ventilating system will be installed, estimated to cost $3000.

Allentown, Pa.—Contract has been awarded to the Aldrich Pump Co., Allentown, for the furnishing of a new 400 hp. mining pump to be used at the mines of the El Ora Mining Co., El Ora, Mexico, to have a capacity of 700 gal. per minute.

Chambersburg, Pa. — Considerable new electrical equipment will be required in connection with the construction of a new cold storage plant by the Gettysburg Ice & Storage Co., to cost about $25,000.

Harrisburg, Pa.—The city has awarded a contract to the Hazard Manufacturing Co., Harrisburg, for the furnishing of a quantity of cable for the proposed extensions to the underground police and fire alarm signal systems.

Oil City, Pa.—The city is having plans prepared for the construction of a new one-story brick addition to the municipal boiler plant. The structure is estimated to cost, with equipment installation, about $45,000.

Felton, Pa.—The residents of Felton have asked the Edison Electric Light & Power Co. to extend its service to that borough and have assured the company that at least 40 subscribers are ready to sign up and that probably as many more will use electricity if the service is given. A survey of the proposed route has been made, but as yet the company has not determined what it can do in the matter.

Philadelphia, Pa.—Bodenstein & Keummerle, Lawrence and Girard avenues, have awarded a contract to the Philadelphia Boiler Works, 1737 Filbert avenue, for the construction of a new stack at their plant, to be used for power purposes.

Pittsburgh, Pa.—Consumers Mining Co., Bessemer building, will construct a pumping plant at its works at Harmarville.

Sayre, Pa.—Sayre Electric Co. has recently inaugurated operations in a new boiler recently installed at its plant. The company is operated by W. S. Barstow & Co., New York.

Baltimore, Md.—The Water Department is planning the installation of a new centrifugal pump, operated by steam turbine, with capacity of 30,000,000 gal. per day, with waterworks condenser, estimated to cost $75,000. This will be used at the Mount Royal pumping station. A centrifugal booster pump, electrically operated, with a daily capacity of 1,000,000 gal. is to be installed on Belair avenue, near Erdman avenue station.

Baltimore, Md.—Aluminum Ore Co. will erect a plant to be located at Sollers Point, which will require considerable electrical, mechanical and machine equipment. While intentions have been announced to proceed with the construction of the plant, it is understood that active work will not commence for a few months. The plant will include a machine shop, forge shop and a number of general shop buildings; a power plant will be constructed with an initial installation of about 4000 kw. capacity in electric generators, steam driven. The boiler plant will be provided with a battery of marine type boilers, equipped with automatic stokers, blowers and overhead coal bunkers.

DATES AHEAD.

Tri-State Water and Light Association. Annual meeting, Greenwood, S. C., April. Secretary-treasurer, W. F. Steiglitz, Columbus, S. C.

Pacific Division, N. E. L. A., Pacific Division, National Electrical Jobbers' Association and California Association of Electrical Contractors and Dealers. Joint convention, Del Coronado, Cal. April 30 to May 2.

National Fire Protection Association. Annual meeting, Ottawa, Ont., May 6-8. Secretary-treasurer, Franklin H Wentworth, 87 Milk street, Boston, Mass.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 12, 13 and 14. Headquarters, Hotel Galvez. Secretary, H. S. Cooper, 403-404 Slaughter building, Dallas, Tex.

National Electric Light Association. Annual convention, Atlantic City, N J., May 19-23. Secretary, T. C. Martin, 33 West 39th street, New York City.

Illinois Association of Electrical Contractors and Dealers. Summer convention, Decatur, Ill., June. Secretary, N. M. Blumenthal, 179 West Washington street, Chicago.

American Society of Mechanical Engineers. Spring meeting, Hotel Statler, Detroit, Mich., June 17-20. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Electrical Engineers. Annual convention, week of June 23, Adirondacks, N. Y. Headquarters, Lake Placid Club. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

Dickeyville, Md.—Baltimore County Water & Power Co., 100 West Fayette street, Baltimore, has awarded a contract to the Price Construction Co., Maryland Trust building, Baltimore, for the construction of a new local one-story and basement pumping station, about 20x30 ft.

Roanoke, Va.—United States Potash & Brick Corporation, recently organized, is arranging for the construction of a plant to cost about $500,000. The works will have a daily capacity of about 500,000 bricks, and machinery will be electrically operated where possible. H. O. Spangler is president of the company.

Wheeling, W. Va.—Gee Electric Co., 1402 Main street, has acquired the building adjoining its plant, and is understood to be arranging plans for the establishment of a new service station in the structure.

Newburn, N. C.—Hammer Lumber Co. is in the market for motors and desires prices on electric motors up to 50 hp.

Spartanburg, S. C.—No opposition was involved in the election held here ratifying the granting of a franchise to the Manufacturers Power Co. The Manufacturers Power Co. is making a development at Saluda, N. C., on Green river. It is understood it will be several months before the plant is in operation.

Alma, Ga.—The city has approved the calling of a special election to vote on the issuance of bonds for $15,000, to provide for the installation of a new municipal electric light plant.

Bainbridge, Ga. — The municipal electric light plant will be improved. The specifications include installing 250 hp. boiler, engine and generator. Address E. N. Edwards, superintendent.

Miami, Fla. — The Miami Beach Electric Co. has incorporated with a capital of $250,000 to build and operate electric railway lines on different streets of the city and to south end of beach, generate and supply electricity for lighting and possibly establish ice factory. Address Carl G. Fisher, president.

NORTH CENTRAL STATES.

Jackson Center, Ohio.—A board of trustees of public affairs has been appointed by the council to have charge of the letting of all contracts to be awarded for the electric lighting system here which will cost $15,000.

Lorain, Ohio.—Cromwell Steel Co. will purchase new motors, generators, table rolls, rolling mill equipment, etc. Estimated cost $190,000. Address J. C. Cromwell, president, Guardian building, Cleveland, Ohio.

Massillon, Ohio.—Northern Ohio Traction & Light Co. will erect $15,000 substation. The building will be 33x33 ft. in dimensions, two stories high, brick and concrete construction, electrically heated, plumbing, composition roofing, fireproof interior finish, substation equipment and electric lighting.

Minerva, Ohio.—Consulting Engineer J. Sheldon, Madison and Water streets, Toledo, Ohio, has prepared plans for a light plant. Address H. A. Pennack, mayor.

Toledo, Ohio.—Welles-Bowen Co. will expend $2,000,000 for the purchase and improvements in the West Moreland allotment. Approximately $600,000 will be expended in paving six miles of street, erecting light, sewers and other improvements. The allotment is being prepared for high grade residences.

Anderson, Ind.—Madison county commissioners will erect a $75,000 tuberculosis hospital.

Bluffton, Ind.—The Indiana Public Service Commission has approved the purchase of the overhead power lines of the defunct Bluffton, Galena & Celina Traction Co. from Thomas Flynn by the Linn Grove Light & Power Co. and also approved an issue of $15,000 worth of additional stock by the Linn Grove company,

increasing the capital of the company to $25,000. The increase is to be used in extensions. The Linn Grove company will purchase current from the Bluffton municipal plant.

Bluffton, Ind.—Farmers near Uniondale will organize company and supply current for a territory four miles north of that town. Current will be secured at Uniondale from the Wabash Valley Utilities Co. and will be purchased at the same rates as Unionville pays. The new company will build distribution system and sell current for light and power.

Brazil, Ind.—Terre Haute, Indianapolis & Eastern Traction Co. has provided better electric light servive for Brazil and vicinity. The company will erect steel poles from the Water Street station of the Terre Haute, Indianapolis & Eastern Traction Co. at Terre Haute to a point where the Clinton and Brazil high tension wires diverge. Another plan is to have a double supply service for Brazil, by extending a high tension line south of Terre Haute into the coal fields of Sullivan county and back through Clay City to Brazil.

Columbus, Ind.—Interstate Public Service Co. will build a transmission line between Southport and Seymour to provide more electric power along the Indianapolis, Columbus & Southern Traction Co. It is understood the first section will be built between Seymour and Columbus which will be advantageous because there is more power in the Columbus plant than is needed while the Seymour plant is often overloaded with work.

Decatur, Ind.—Farmers Light & Power Co. and the Preble Light & Power Co. have petitioned the Indiana Public Service Commission for permission to issue $5000 and $8000 of capital stock. The petitioners are distributing companies. They wish to extend their lines in Adams county.

Fort Wayne, Ind.—Associated trustees of all of the Fort Wayne Masonic lodges have decided to erect a Masonic Temple to cost between $250,000 and $300,000. Plans have not been drawn for the building. Address William Geke, Fort Wayne, Ind.

Gary, Ind.—Permits for new buildings to cost $250,000 have been taken out in Gary since the first of the year. More than $1,000,000 will be spent on new buildings in the near future. Among the buildings planned this spring is a $250,000 theater, a $200,000 hospital and several business houses costing from $20.000 to $50,000 each. More than 100 residences and flat buildings will be built, or are now under construction.

Gary, Ind.—O. K. Battery Co., a Delaware corporation, has qualified to do business in Indiana, with $200,000 of its capital represented in that state. George H. Manlove, Gary, Ind., is named as agent.

Gary, Ind.—Fire of undetermined origin has destroyed the electrical department of Gary Screw & Bolt Works, causing damage estimated at $100,000.

Indianapolis, Ind.—Merchants Heat & Light Co. has been petitioned to supply electrical service in Indianapolis Heights and Rockville Gardens.

Marion, Ind.—Delta Electric Co., which during the war supplied a large part of the electric lighting apparatus used in the army and navy, has announced plans for a large addition to its Marion plant for the manufacture of dry cell batteries. The factory will have a capacity of 15,000 batteries daily and will be the largest of its kind in the Middle West.

Monmouth (R. F. D. from Decatur), Ind.—Monmouth Light & Power Co. is being organized to furnish light and power.

Peru, Ind.—A number of farmers living on the Strawtown Pike, south of the city, presented a petition to the city council in which they are asking for electric current for lighting their homes and to use in operating small motors to be used in pumping water, grinding feed, etc. Address Light Superintendent Anderson.

Bloomington, Ill.—Bloomington & Normal Light & Power Co. will extend its distribution system to include a large rural territory at Meadows, Ill.

Grafton, Ill.—Grafton is to have a modern electric light and power system according to a contract embodied in an ordinance passed by the city council. Roscoe Johnson, of St. Louis, president of the Grafton Clay Products Co., is given a 20-year franchise and contracts to install a light and power plant within eight months. Light and power will be charged for at the rate of 15 cents a kw-h. up to 30 hours, and thereafter at the rate of 12 cents. A continuous current is required under the terms of the contract.

Rockford, Ill.—Rockford Interurban Railway Co. and the Rockford City Traction Co. have petitioned for authority to issue and sell first mortgage 5% gold bonds of the Rockford Interurban Railway Co.

Benson, Minn.—It is planned by the city officials to erect an addition to the municipal electric lighting plant to cost about $30,000. Theodore H. Lee is superintendent; W. E. Skinner, Plymouth building, Minneapolis, is engineer.

Davenport, Iowa.—Tri-City Plate Ice Co. will build brick building, 35-ton a day capacity, to cost $50,000. Contract has been awarded to Vilter Manufacturing Co., Milwaukee, Wis.

Davenport, Iowa.—The work of laying gas mains and making electrical connections for 186 Government houses has been started by the Peoples Light Co.

Dubuque, Iowa.—The Council has signed a five-year contract with the Dubuque Electric Co. The contract, as finally agreed upon, differs from the one originally submitted by the electric company. The elimination of the purchase clause, by which the city was bound to buy the entire equipment including street cars and power plant was made by the city attorney and a clause inserted providing that any alterations in the contract must be mutually agreed upon. A stipulation reads that the city is privileged to install, change or modify 100 lights during the period of the contract. This may be done during the first year, or if not, 36 during the first year and 16 during each successive year and the cost of installation must be borne by the electric company. When new lights are installed, they must not be more than one block from the nearest present light.

Carrollton, Mo.—Water, Light & Transit Co. plans to install centrifugal pumps and add other equipment to its waterworks plant. E. E. Harper, Kansas City, Mo., is engineer in charge.

St. Joseph, Mo.—St. Joseph Street Railway, Light, Heat & Power Co. has decided upon new improvements which will cost $1,000,000. All obselete machinery will be replaced and the plant greatly enlarged. A new power house will not be built but practically all new equipment will be installed. Additional pumps will be placed in service so that the company will not be dependent upon city water. Henry L. Doherty & Co., New York, will furnish the needed machinery. Address J. H. Van Brunt, general manager, St. Joseph, Mo.

El Dorado, Kans.—Additional street lights are to be purchased and other extensions are contemplated.

Chadron, Neb.—Chadron Electric Co., J. M. Cain, owner, contemplates the construction of an electric light plant to supply the city with commercial current.

Sterling, Neb.—Bids will be called for soon for constructing a transmission line from Tecumseh to Sterling. The material has been purchased at a cost of $16,000. Grant & Fulton, Lincoln, Neb., engineers.

SOUTH CENTRAL STATES.

Louisville, Ky.—Louisville Gas & Electric Co. during the week ended March 1 secured 68 new electric light and power customers with 27 kw. of lighting and 817 hp. of motors. Electric energy output showed an increase of 16% over the corresponding period a year ago.

Winchester, Ky.—Kentucky Utilities Co., it is reported, will install two 20-ton ice plants.

Baldwin, Ala.—Linking up Mobile and Baldwin counties through the agency of the proposed interurban line along the coast between Mobile and New Orleans is proposed by the people of Baldwin. Address William McIntosh of Foley.

Florence, Ala.—Evans & Brown have been engaged to prepare plans for municipal electric lighting system.

Mobile, Ala.—H. M. Byllesby & Co., owners of the Mobile Electric Co., propose to build a new power plant at some point on the Mobile river or Three-Mile creek. This plant, which will involve the expenditure of about $1,000,000, will be erected in addition to the present power house at Royal and St. Anthony streets, which was partially wrecked by a recent explosion.

Lexington, Miss.—The city is considering plans for the installation of a new municipal electric plant. W. L. Jordan is city clerk.

Pascagoula, Miss.—The city has arranged plans for the installation of underground wiring to be used in connection with the electric light system.

Senatobia, Miss.—The city is arranging plans for the issuance of $15,000 in bonds to provide for the construction of a new electric light and water system.

Fort Smith, Ark.—Majestic Coal Co., recently organized, is in the market for mining machinery and power plant equipment.

Little Rock, Ark.—Arkansas Hydro-Electric Development Co. has filed with the Secretary of State notice of an increase in its capitalization from $50,000 to $500,000, to provide for general expansion, etc.

Bristow, Okla.—Bristow Ice & Light Co. will improve and enlarge its ice plant.

Drumright, Okla.—Oklahoma Gas & Electric Co. is negotiating with Swift & Co. for supplying electrical energy to operate a refrigerating machine requiring 35 hp. in motors.

Grove, Okla.—The municipal light and water plants are proving inadequate to supply the increasing demands made upon them. Plans are being made to vote bonds to make extensions to both plants.

Hennesay, Okla.—George Massey, who owns and operates one of the largest privately owned telephone systems in Oklahoma, is planning to replace his wooden poles with concrete posts. A number of other important improvements are also contemplated for this spring.

Muskogee, Okla.—Plans are being arranged for the installation of a new electric street lighting system on West Broadway, between Sixth and Seventh streets.

Pawhuska, Okla.—The city is planning for extensive improvements in the municipal power plant, and it is understood that monds for $250,000 will be issued to provide for the work.

Oklahoma City, Okla.—The proposed reductions in the price of electric current in Oklahoma City and eight other cities in the state is only the forerunner of sweeping investigations to be made by the Corporation Commission with a view of reducing increased rates granted to numerous public utilities during the period of the war. The proposed net rates in the Oklahoma cities affected will be 10.8 cents in Oklahoma City; 11.7 cents in Muskogee, El Reno and Enid; 13.5 cents in Moore, Hemmesy, Waukomis and Keifer, and 12.6 in Fort Gibson.

Sapulpa, Okla.—Sapulpa Electric Co. has installed three transformers to care for the new power load of the Frisco railroad, amounting to 303 hp. in motors.

Canyon, Tex.—A Fairbanks-Morse engine of the latest type has been purchased for the water plant and the city is soon to purchase additional equipment costing about $5000.

San Angelo, Tex.—An election was held recently to vote on a $500,000 bond issue for the establishment of a municipal power plant and waterworks.

Sugarland, Tex.—The Sugarland Industries, Inc., is considering the construction of a large new power plant to provide for operation of the various departments of subsidiary companies. G. D. Ulrich is vice-president and general manager.

WESTERN STATES.

Cut Bank, Mont.—Citizens voted to grant a franchise for establishment of an electric light plant and the extension of the telephone system. Within 60 to 90 days the company interested in the electric light franchise expects to have the first unit in operation.

Ronan, Mont.—Stephen Walner of Butte is investigating the matter of an electric light plant at this place.

Sedgwick, Colo.—Election will be called in the near future to vote $30,000 in bonds for electric lights and waterworks. Henningson Engineering Co., engineer, Omaha, Neb.

Colfax, Wash.—The installation of a small municipal electric lighting plant is under consideration.

Seattle, Wash.—Geo. F. Nicholson, chief engineer of Port of Seattle, has recommended the installation of a hoisting magnet at Pier 1, Smith's Cove terminal, for use in handling steel and iron, and for the recovery of steel and iron lost in the water in slips adjoining the pier. The probable purchase involves a magnet costing about $1800 and a generator costing $1875.

Seattle, Wash.—J. J. Agutter & Co., electrical engineers and contractors, Seattle, have finished the lighting and power installations in the plant of the Air Reduction Sales Co., East Marginal Way, also the power and lighting installations at the new Chauncey Wright restaurant.

Selah. Wash.—Pacific Power & Light Co. has just closed a contract for the construction of a 6600-volt single-phase distribution line running east from this place to serve nine ranches. The company is also building a 6600-volt, three-phase line to serve Terrace Heights pumping station No. 2, southeast of the Yakima Country Club house.

Tacoma, Wash.—That the municipal street railway is not earning enough money to pay interest on outstanding bond issues is the statement of City Comptroller John Roberts of Tacoma to the city council. The controller urged the council to find some method of meeting unpaid bills.

PROPOSALS

Street Lighting Material.—Bids will be received April 8 for installing of such street lighting materials as are required for a portion of a street lighting distribution system, according to specifications on file. Address Percy Braman, deputy commissioner of public works, Milwaukee, Wis.

Milling Machine.—Bids for furnishing all labor, materials and equipment necessary, and designing and constructing an electrically driven milling machine for use in finishing the edges of electro-deposited copper printing plates, the sizes of which range from 18x24 in. to 38x48 in., will be received by the superintendent of the U. S. Coast and Geodetic Survey, 205 New Jersey avenue, S. E., Washington, D. C., April 9, and will then be opened in the presence of the attending bidders.

Motor-Driven Drilling Machines, Lathes, Etc.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following tools for the navy yard at Norfolk, Va.: 21 radial drills, 10 24-inch drilling machines, 2 heavy-duty turret lathes, 5 21-inch heavy-duty engine lathes, triple gear, all motor-driven.

Power Plant Equipment.—Bids will be received until 1 p. m., April 2 for remodeling the municipal power plant, and furnishing and installing complete steam-electric power plant equipment. D. D. McEachin, secretary.

Distribution System.—Bids will be received until 8 p. m., April 7 at Virginia, Minn., for the construction of a distribution system for the municipal central heating system, and pipe, valves, insulation covering, etc. Inquiries should be addressed to Edward Wenzel, secretary of the Water and Light Commission.

INCORPORATIONS

New York, N. Y.—Manufacturers' Equipment Exchange. Capital, $50,000. To manufacture motors, engines, etc. Incorporators: R. Grant, H. B. and A. C. Ackerly, 914 Ditmas avenue, Brooklyn.

New Brunswick, N. J.—Wright-Jeffries Tire & Battery Co. Capital, $10,000. To manufacture electric batteries, etc. Incorporators: J. M Jeffries and W. M. Blackbuam, New Brunswick; and Tullus Wright, Philadelphia, Pa.

Newark, N. J.—Battery & Electric Service, Inc. Capital, $25,000. To manufacture storage batteries, etc. Incorporators: A. and C. Lion, and R. Levy, Newark.

New York, N. Y.—General Heating Co., Inc. Incorporated in Delaware with a capital of $1,000,000, to manufacture heating equipment, etc. Incorporators: Frank T. Sargent, New York; Albert E. Mayes, New Rochelle.

Washington, D. C.—Owens Electric Welding Co. Capital, $100,000. Incorporated under Delaware laws, to engage in general electrical welding operations. Incorporators: L. F. Sarscer, W. J. Dow, and K. King Cornwell, all of Washington.

Personal

J. N. Adam Joins Belden Manufacturing — Davis H. Tuck Accepts Position with Holophane Glass — Other Changes

C. W. LEBER, 20 Park Row, New York, has been appointed to act as local representative for the American Radio & Research Corporation, a Delaware corporation.

LAWRENCE A. COLEMAN, assistant secretary of the United Electric Light & Power Co., New York, has been appointed treasurer of the company.

I. F. HALTON, 2 Rector Street, New York, has been appointed to act as local representative for the Benson Electric Co., of Minnesota.

C. L. CLARY, for the past five years connected with the P-K Engineers of St. Louis, Mo., has accepted the appointment of district manager in charge of the St. Louis office of the Chuse Engine & Manufacturing Co.

W. H. DIEFENDORF, of Syracuse, New York, has resigned his position of chief engineer and as a director of the New Process Gear Corporation to associate himself with the Weeks-Hoffman Co. of the same city.

W. R. HONDREY, 314 Hoge building, Seattle, district agent for Delta Star Electric Co., Whiting Foundry Equipment Co. and other interests, Seattle, is making a five weeks' business trip through the East, including in his itinerary Chicago, Pittsburgh, New York, Boston and Des Moines, Iowa.

GEORGE K. HEYER is the new assistant telephone sales manager of the Western Electric Co., having been promoted from the position of railway sales engineer. He has been an employe of the company since 1902 and will continue to make his headquarters in New York.

FRANK HEIPLE, local superintendent for the Central Illinois Light Co., has been promoted to the position of sales manager, with headquarters in Peoria. Mr. Heiple joined the company about eight years ago, assuming the position of cashier, and at the end of three years became superintendent, serving in this capacity until his recent promotion.

DAVIS H. TUCK, until recently assistant physicist for the United States Public Health Service, is now commercial engineer for industrial and street lighting with the Holophane Glass Co., New York. Mr. Tuck is a graduate of the 1911 class of the Massachusetts Institute of Technology, and has since served with the photometric department of the United States Bureau of Standards at Washington, D. C., and as illuminating engineer for the United States Public Health Division of Field Investigation of Industrial Hygiene. While engaged in this work Mr. Tuck made a study of illumination in the garment industry, New York City; the steel industry, Pittsburgh, and public buildings, Washington. He will be in charge of the industrial lighting department of the Holophane company.

R. M. COLE formerly with Thompson & Castleton, electrical engineers, Seattle, is now with the Economy Fuse Manufacturing Co., Seattle.

A. W. HARTIGAN, in charge of electrical equipment and raw materials of electrical industry for J. E. Dockendorff & Co., Inc., New York, has recently returned from Japan, where connections were made with prominent Japanese firms to handle the commodities represented by this house.

CAPT. GEORGE SYKES, who has been in this country nearly four years, attached to the British War Mission in a commercial capacity, will sail for Europe in May. He has joined the Dutilh-Smith-McMillan Co., an international house, as London manager of its engineering and railroad departments. For many years prior to the war, Captain Sykes was connected with electrical manufacturers in the sales and engineering departments and power traction corporations. His New York address is 50 Broad street, and his London office is Central Buildings, Totehill street, Westminster.

E. E. MAHER, who has been selling mechanical equipment in the Chicago territory for the past ten years, and who has for the past year been acting as district sales manager for the Terry Steam Turbine Co., has resigned to resume business for himself. Mr. Maher is opening offices in the Michigan Boulevard building, and has taken on a line of centrifugal pumps, high speed steam engines, air compressors, refrigerating apparatus, etc. He has gathered together an efficient engineering organization which is equipped to handle installation as well as sales of his apparatus. Mr. Maher has a wide acquaintance among architects, engineers and contractors, and his venture should prove successful.

J. N. ADAM, after serving in the new-business department of the Public Service Electric Co. of New Jersey for nine years, has tendered his resignation to become associated with S. C. Schrenck, Eastern manager for the Belden Manufacturing Co., of Chicago, as well as the southeastern section of the Atlantic seaboard. During his association with the New Jersey company, Mr. Adam was prominent in the various activities of the company as well as an active member of the Illuminating Engineering Society and the National Electric Light Association. He has served on various committees of the former society and has for the past six years been a local representative for New Jersey. He is at the present time chairmain of the store-lighting committee of the N. E. L. A.

JAMES M. BROWN, formerly western sales manager of the Electric Cable Co., has recently been appointed special representative of the automotive equipment and electrical departments of the H. W. Johns-Manville Co., with headquarters in Chicago.

C. E. HAGUE, formerly production engineer of the Mid-West Engine Co., Indianapolis, Ind., has been appointed sales manager of the American Steam Conveyor Corporation, Chicago, manufacturer of the American steam ash conveyor and other ash handling equipment.

G. A. RICHARDSON, superintendent of transportation for the Puget Sound Traction, Light & Power Co., Seattle, Wash., has accepted the position of general superintendent of the Philadelphia Rapid Transit system at Philadelphia.

JOSEPH L. JAFFE, secretary and sales manager of the Perfeclite Co., Seattle, recently returned from California after placing agencies, and has departed for New York and other eastern cities in connection with the Perfeclite lighting fixture business. He will place agencies in a number of the larger eastern cities.

R. R. CASKEY, for six years office manager of the Chicago branch of the Robbins & Myers Co., Springfield, Ohio, recently opened a district sales office for the Northwestern Manufacturing Co., of Milwaukee, Wis., at 1120 Conway building, Chicago. The Northwestern Manufacturing Co. builds a full line of direct current and alternating-current motors and generators and other special electrical machinery.

LEON W. ROSENTHAL, formerly a consulting electrical engineer and patent solicitor of New York City, was recently elected a vice-president of the American Bosch Magneto Corporation, which upon the sale by the Alien Property Custodian, acquired the interests of the Bosch Magneto Co. Mr. Rosenthal will make his headquarters at the factory in Springfield, Mass., but will also have an office in New York City at 223 West 46th street.

Obituary.

PAUL S. BECK, of Fanwood, N. J., manager of the Moon Wire Co., Garwood N. J., died on March 16, following an attack of influenza. Mr. Beck was in his thirty-seventh year.

EMIL C. BRAUN, employed in the engineering department of H. M. Byllesby & Co., Chicago, died very suddenly on March 23. Mr. Braun was a well known electrical engineer who came to America in charge of the German electrical exhibit at the World's Fair in 1893. He was 51 years old, and a graduate of the University of Berlin electrical engineering college.

Financial News

Cities Service to Increase Authorized Stock.

The stockholders of Cities Service Co. at the annual meeting of the company in Dover, Del., on April 8 will be asked to approve an increase in the authorized preferred capital stock of the company from $100,000,000 to $150,000,000. It is felt by the directors of the company in view of the great expansion of activities of Cities Service Co. and its development as one of the most important factors in the oil business in the United States, that provision should be made for the future financial requirements of the company as well as conversion of outstanding senior securities through the approval by the stockholders of a larger authorized amount of preferred stock, even though it is not the intention of the directors to issue any of the new stock within the near future.

The Cities Service Co. at the present time has an authorized capitalization of preferred stock of $100,000,000, of which $70,807,936 is outstanding. The company has outstanding approximately $31,000,000 of convertible securities, all of which will become convertible into stocks of the company within the next two years. To provide for the conversion of these securities will require approximately $27,000,000 par value of preferred stock, and it is felt provision for this conversion should be made now. The conversion of these securities would absorb substantially the entire amount of unissued preferred stock under the present capitalization and, therefore, it was deemed wise by the board of directors at this time to place the company in a position, with the approval of the stockholders, not only to have sufficient unissued preferred stock to meet the conversion of the outstanding senior securities, but also where it would be able with improving conditions in the investment market to finance any requirements it might have through the issue and sale of its preferred stock thereby making any new capital so secured a permanent part of the capitalization of the company.

No increase will be asked in the present authorized common capital stock of the company, as it is believed that there is no necessity for increasing this at the present time beyond the authorized amount of $50,000,000.

Paducah Traction & Light Reorganized.

Details of the reorganization of the Paducah Traction & Light Company have been announced. A bondholders' committee has been appointed, consisting of Major John B. Pirtle, chairman; L. H. McHenry and J. D. Macquote. It is proposed to take the property out of the receiver's hands through the reorganization which it is proposed to make operative by July 1. Holders of Paducah Traction & Light Co. 5% preferred stock will receive 25% par value of their holdings in par value of the stock of the Paducah Electric Co. Holders of Paducah Traction & Light common stock will not be entitled to participate in the reorganization. Holders of Peoples' Light, Power & Railway Co. 6% bonds, extended to Sept. 1, 1918, with Sept. 1, 1918, coupons attached, will receive their face value in cash and interest accrued but unpaid to date of payment or at their option five-year 6% mortgage bonds of Paducah Electric Co., Incorporated, to bear interest from Jan. 1, 1919, exchangeable face value for face value, with interest accrued but unpaid to Jan. 1, 1919, in cash. Holders of Paducah Street Railway Co. 6% bonds, due 1920, with July 1, 1918, and subsequent coupons attached, will receive the face value thereof in cash and interest accrued but unpaid from July 1, 1918, to the date of payment, or at their option five-year 6% mortgage bonds of Paducah Electric Company, incorporated, to bear interest from Jan. 1, 1919, exchangeable face value for face value with interest accrued but unpaid from July 1, 1918, to Jan. 1, 1919, in cash. Holders of Paducah Street Railway Co. 6% bonds due 1923 and 1932 have similar privileges.

Electric Lines in Straits.

Describing the condition of the electric railways of the country as demoralized, Philip H. Gadsden, of Charleston, S. C., speaking at the midyear meeting of the American Electric Railway Association in New York, declared that a "cost of service" system of regulating fares, or, as an alternative, municipal ownership, must be adopted to rehabilitate the industry. Mr. Gadsden is chairman of the association's committee of readjustment, which has been studying the electric railway problem.

Public Utilities Elects Officers.

Directors and officers for the ensuing year of the Public Utilities Co. of Evansville, Ind., operating the Evansville city street car lines and the Evansville and Princeton traction line, have been elected as follows: B. C. Cobb, New York, president; W. H. Barthold, New York, first vice-president; Henry W. Marshall, Lafayette, Ind., second vice-president; Frank J. Hass, third vice-president and general manager; C. H. Stilittolfe, Evansville, Ind., secretary; C. E. Oswald, Evansville, treasurer. The directors are William H. McCurdy, S. W. Cook, Charles W. Cook, Henry E. Dreier, Daniel H. Ortmeyer and Frank J. Haas, of Evansville, Ind.; Henry W. Cobb, Lafayette, Ind., and B. C. Cobb and W. H. Barthold, of New York.

Hawks Electric to Issue Mortgage Bonds.

Hawks Electric Co., Goshen, Ind., has petitioned Indiana Public Service Commission for authority to issue $1,000,000 of 20-year 6% mortgage bonds. The company wishes to execute $261,000 of the bonds immediately to retire $230,000 of first mortgage bonds now outstanding. The company desires to sell the new bonds at 90% of par and to retire outstanding bonds at 102. The company also petitions to execute $125,000 of general and refunding mortgage bonds to sell at 90, to finance improvements and make additions to the plant. The Hawks Electric Co. is capitalized at $300,000, with $200,000 common stock outstanding.

Galveston-Houston Electric Notes.

An issue of $1,500,000 Galveston-Houston Electric Co. three-year 7% secured notes, dated March 1, 1919, and due March 1, 1922, is being offered by Lee, Higginson & Co. at 98½ and interest, to yield over 7.55%. The company owns the capital stock of the Galveston Electric Co., the Houston Electric Co. and the Galveston - Houston Electric Railway Co., which companies do the entire electric railway and a portion of the electric lighting and power business in Galveston, Tex.; the electric railway business in Houston, Tex., and operate on interurban electric railway between the cities of Galveston and Houston. The proceeds of these notes will provide for the retirement of the company's entire floating debt incurred for additions and improvements and for necessary requirements through 1919.

Western Union Reports Loss in Earnings.

The annual report of the Western Union Telegraph Co. for 1918 shows a balance available for dividends of $10,460,997, as compared with a balance of $11,715,366 in the preceding year. The income account shows the division between private operation of the lines and the government operation. During the seven months ended July 31, when the company was still under private control, the gross operating revenue was $54,283,400 and the operating expenses amounted to $46,604,926. The operating revenue for the full year of 1917 was $76,995,511 and the expenses $62,783,006.

The income of the company last year was added to by the government compensation, which amounted to $3,327,112, this applying to the land lines only from Aug. 1 to Dec. 31. The surplus of the company at the close of last year was $32,018,993, as compared with $29,248,410 at the end of 1917.

Salem Lighting Company Authorized to Issue Bonds.

The Public Utilities Commission of Ohio in a decision recently handed down has authorized the Salem Lighting Co., of Salem, Ohio, to issue $83,000 par value first mortgage 5% 20-year gold bonds in the sum of $56,000 and its common capital stock of the par value of $25,900. These bonds and capital stock are to be sold for not less than 80% of the par value of the stock. The proceeds arising from the sale will be used to discharge the company's indebtedness of the Municipal Lighting Co. on account of the advances made by that company, providing for additions, extensions and betterments up to Oct. 31, 1917. The Commission in its decision states that from Dec. 1, 1915, to Feb. 28, 1917, the Salem company incurred an indebtedness of $14,603.46 for and on account of additions, extensions and betterments, that between the dates of March 1, 1917, and Oct. 31, 1917, it incurred further indebtedness of $56,098.20 on account of other additions and betterments.

Dividends.

Iowa Railway & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable March 31 to stock of record March 20.

A quarterly dividend of 3% has been declared by the Youngstown Sheet & Tube Co.; also a quarterly dividend of 1¾% on preferred stock, both payable April 1 to stock of record March 20.

Detroit Edison Co. has declared a quarterly dividend of 2%, payable April 15 to stock of record March 31.

The board of directors of the Western Electric Co. has declared a quarterly dividend of $2.50, payable March 31.

Nashville Power & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable April 1 to stock of record March 15.

Carolina Power & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable April 1 to stock of record March 18.

Michigan State Telephone Co. has declared a quarterly dividend of $1.50 on preferred stock, payable March 31 to stock of record March 24.

Dayton Power & Light Co. has declared a quarterly dividend of $1.50 on preferred stock, payable April 1 to stock of record March 20.

Directors of the Ottawa Light, Heat & Power Co. have declared a quarterly dividend of 1½%, payable April 1 to stock of record March 20.

Duluth Edison Electric Co. has declared a quarterly dividend of 1½% on preferred stock, payable April 1 to stock of record March 21.

Westinghouse Air Brake Co. has declared a quarterly dividend of $1.75, payable April 30 to stock of record March 31.

Public Service Corporation of New Jersey has declared a quarterly dividend of 1½%, payable March 31 to stock of record March 28.

The board of directors of the Erie Lighting Co. has declared a quarterly dividend of 1¾% on preferred stock, payable April 1 to stock of record March 27.

Ohio State Telephone Co. has declared a quarterly dividend of 1¾% on preferred stock, payable April 1 to stock of record March 20.

Southwestern Cities Electric Co. has declared a quarterly dividend of 1¾% on preferred stock, payable April 1 to stock of record March 15.

For the Readjustment Period—What?

XXX.

The Elements of Credit

CHARACTER is the foundation of credit. Frequent personal contact between bankers and business men promotes a true appraisal of this factor.

ABILITY of the men at the head of a business has weight in determining the credit to which the business is entitled.

PRESTIGE of a firm or its product is a substantial item in maintaining credit.

EARNINGS are an important consideration in fixing the borrowing power of a business.

ASSETS and their relation to liabilities form a vital equation in the statistical data upon which borrowing capacity is estimated.

NET WORTH. The increase in net worth, from year to year, proportionate to the growth of a business, has a definite bearing on credit.

HABITS OF PAY. A cash discounting record in paying bills is another of the statistical facts upon which loans are based.

BANK BALANCES. The daily bank balance of the borrower is always a factor in obtaining credit.

AUDITED STATEMENTS afford an excellent basis for discussing credit between the business man and his bank.

THE MEASURE OF CREDIT is a carefully balanced operation which considers specific facts and less tangible values also.

The specific and intangible elements, which constitute the measure of credit, are strengthened by ADVERTISING: It reflects CHARACTER and ABILITY, adds PRESTIGE, increases EARNINGS and ASSETS, all of which result in greater NET WORTH. These elements in turn determine the HABITS OF PAY and BANK BALANCE.

INSTITUTIONAL advertising creates prestige and good will, without which the elements of credit would totter and fall. Specific advertising increases earning and assets, which in turn determine net worth—a most vital element of credit. In this period of Industrial Readjustment both are playing a very prominent part.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

A quarterly cash dividend of 1¼% on preferred stock has been declared by the Pacific Telephone & Telegraph Co., payable April 15 to stock of record March 31.

Cincinnati Bell Telephone Co. has declared a quarterly dividend of 2%, payable April 1 to stock of record March 24.

Cincinnati Gas & Electric Co. has declared a quarterly dividend of 1¼%, payable April 1 to stock of record March 14.

A quarterly dividend of 1% on preferred stock has been declared by the Western Power Co., payable April 15 to stock of record March 31.

Kansas Gas & Electric Co. has declared stock dividend No. 36, viz, a regular quarterly dividend of 1¾% on the preferred stock of the company for the quarter ending March 31, 1919, payable April 1 to stockholders of record of March 22.

The directors of Cities Service Co. have declared the regular monthly dividend on the preferred stock of ½ of 1% in cash, or 6% per annum, and on the common stock the regular monthly dividend of ½ of 1% in cash, or 6% per annum, and 1% in common stock, or at the rate of 12% per annum. These dividends are payable May 1 to stockholders of record of April 15.

Earnings of Texas Companies Show Decrease.

Reports just filed with the city by the Houston Electric Co., the Galveston-Houston Electric Co. and the Houston Light & Power Co., covering the calendar year of 1918, show decreases of earnings as compared with the preceding year.

The gross receipts of the Houston Electric Co. during the year were $1,562,937; the cost of operation was $1,114,211; taxes, $104,380; interest on bonds, $157,313, and bond sinking fund, $37,500. This total was $1,413,404, leaving $149,532. Out of this sum it is understood the company paid at least $100,000 in dividends, leaving a very small amount for depreciation. The whole amount, if applied to the payment of dividends, would pay less than 3% on the capital stock of the company.

The statement says the company has $2,500,000 of bonds and $704,740 of other indebtedness.

The Galveston-Houston Electric Co.'s statement shows gross receipts of $720,885, with operation expenses of $369,950, and taxes and interest and sinking fund charges of $239,675, leaving $111,160 for the payment of dividends, depreciation and storm damage.

The Houston Light & Power Co. in its statement shows that its revenues for the last year were $997,301 and its operating expenses were $579,940, leaving a revenue of $417,360. It had to pay taxes of $183,752, which left a net income of $232,608. The company, under its agreement with the city, gets 8% on its investment, which it now estimates at $2,963,820. Deducting the 8% on this investment, or $226,578, it left $7,038, of which the city gets one-half under the agreement.

Surface Line Earnings Make Poor Showing.

The annual report of the Chicago Surface Lines for the fiscal year ended Jan. 31, 1919, makes a dismal showing for the holders of local traction securities, particularly the junior securities. In his report to the stockholders of the Chicago City Railway Co., President L. A. Busby calls attention to wage increases and the increase cost of materials and supplies. "At the present time," he states, "the company is not earning the 5% interest rate fixed by ordinance on its purchase price."

For the entire year the company managed to earn the 5% return and to make a small division of profits with the city, but, as Mr. Busby points out, the figures for the year "do not reflect the full result of the second wage increase, which was effective only during the last six months of the year and the company is now operating at an annual loss far heavier than that indicated by the figures. The only relief possible is through additional revenue from an increase in fares."

Despite the poor showing, the Chicago City Railway Co. voted to resume dividend payments on the stock, which for the first time in 60 years were suspended late in 1918. The directors have declared a quarterly dividend of 1¼%, payable March 31, 1919, to stockholders of record March 25.

During the year gross receipts of the Surface Lines decreased $404,535, while operating expenses increased $2,630,241, making a decrease in residue receipts of $3,034,776.

After the payment of operating expenses and bond interest the net income of the Chicago City Railway Co. was reduced from $1,501,384.66 last year to $846,186.61 this year.

During the year the company built one extension of 2.75 miles. This was done at the request of the United States Government. Funds for the work were loaned by the United States Housing Corporation.

The income account, with comparison, follows:

	1919.	1918.
Gross earnings	$34,710,098	$35,114,633
Expenses—		
Maintenance	3,810,266	3,214,948
Renewals	2,776,808	2,835,636
Power—operation	2,841,211	2,558,192
Conducting transportation	12,477,148	10,802,009
General and miscellaneous, inc. board of supervising engineers	2,366,504	2,197,908
Taxes	1,460,000	1,493,000
Total exp. of oper.	$25,731,937	$23,101,695
Residue receipts	8,978,161	12,012,037
Dividend:		
Chi. Rys. Co., 60%	5,386,897	7,207,762
South Side Lines, 40%	3,591,264	4,805,174

The Chicago City Railway Co.'s separate income account is appended:

	1919.	1918.
40% of the residue receipts of Chicago Surface Lines	$3,591,264	$4,805,174
Deduct: Joint account expenses, interest on capital investment of Chicago City Railway Co., Calumet & South Chicago Ry. Co. and Southern St. Ry. Co.	3,580,614	3,661,805
Net earnings of Chicago City Ry. Co.	$ 10,650	$1,143,369
City's proportion, 55%, as per ordinance	5,857	628,853
Company's proportion, 45%, as per ordinance.	$ 4,793	514,516
Add: Interest on capital investment	2,668,657	2,623,510
Income from operation.	$2,673,450	$3,188,026
Other income—deficit	72,046	*58,358
Total income	$2,601,404	$3,196,884
Interest on bonds and notes	1,755,217	1,695,000
Net income	$ 846,187	$1,501,384
Previous surplus	104,613	187,902
Surplus	$ 950,800	$1,689,287
Dividends, 5%	900,000	1,575,000
Miscellaneous	160	9,674
Surplus remaining	$ 50,639	$ 104,613
Percentage of net income to capital stock	4.07	8.34

*Net income.

The Chicago City Railway Co.'s balance sheet as at Jan. 31 follows:

ASSETS.

	1919.	1918.
Purchase price of property in terms of ordinance	$53,741,633	$53,096,305
Accounts receivable	81,371	55,584
Real estate	13,648	13,648
Cash on hand	872,309	933,326
Total assets	$54,708,961	$54,098,865

LIABILITIES.

First mortgage bonds	$33,900,000	$33,900,000
Notes payable	*1,700,000	1,200,000
Bond interest and accounts payable	1,058,322	894,252
Surplus assets:		
Represented by equity of $18,000,000 capital stock.	18,050,639	18,104,613
Total liabilities	$54,708,961	$54,098,865

*Secured by $1,200,000 bonds deposited prior to Jan. 31, 1919, and $500,000 deposited subsequently.

The Calumet & South Chicago Railway Co. for the 1919 fiscal year reports total net income of $558,813, which after payment of bond interest left a balance of $265,875. Of this $200,000 was paid in dividends.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Mar. 18.	Bid Mar. 25.
Adirondack Electric Power of Glens Falls, common	6	13	17
Adirondack Electric Power of Glens Falls, preferred	6	73½	72
American Gas & Electric of New York, common	10+extra	100	120
American Gas & Electric of New York, preferred	6	43	41
American Light & Traction of New York, common	..	241	240
American Light & Traction of New York, preferred	6	98½	98½
American Power & Light of New York, common	4	60	57
American Power & Light of New York, preferred	6	77	71
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	7	33	33
American Telephone & Telegraph of New York	..	104½	104¼
American Water Works & Elec. of New York, common	..	6	6
American Water Works & Elec. of New York, particip	7	8	11
American Water Works & Elec. of New York, first preferred	..	65	54
Appalachian Power, common	..	3	7
Appalachian Power, preferred	7	..	..
Cities Service of New York, common	+extra	345	345
Cities Service of New York, preferred	6	79¼	79¼
Commonwealth Edison of Chicago	8	113½	114
Comm. Power, Railway & Light of Jackson, common	..	18	18
Comm. Power, Railway & Light of Jackson, preferred	6	42	42
Federal Light & Traction of New York, common	..	9	9
Federal Light & Traction of New York, preferred	..	42	44
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	23
Middle West Utilities of Chicago, preferred	6	49	48
Northern States Power of Chicago, common	..	72	70
Northern States Power of Chicago, preferred	ex.div.7	91	91
Pacific Gas & Electric of San Francisco, common	..	51	52
Pacific Gas & Electric of San Francisco, preferred	6	87	87
Public Service of Northern Illinois, Chicago, common	7	90½	90
Public Service of Northern Illinois, Chicago, preferred	6	89½	90
Republic Railway & Light of Youngstown, common	4	22	21½
Republic Railway & Light of Youngstown, preferred	6	58	58
Standard Gas & Electric of Chicago, common	..	24	29
Standard Gas & Electric of Chicago, preferred	6	41¾	44
Tennessee Railway, Light & Power of Chattanooga, common	..	4½	5
Tennessee Railway, Light & Power of Chattanooga, preferred	6	24	22
United Light & Railways of Grand Rapids, common	4	39	39½
United Light & Railways of Grand Rapids, preferred	6	71	71½
Western Power of San Francisco, common	..	18	17
Western Union Telegraph of New York	extra	89	86¾
Industries—			
Electric Storage of Philadelphia, common	4	56½	70
General Electric of Schenectady	8	155½	156
Westinghouse Electric & Mfg. of Pittsburgh, common	7	46½	47⅛
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	55